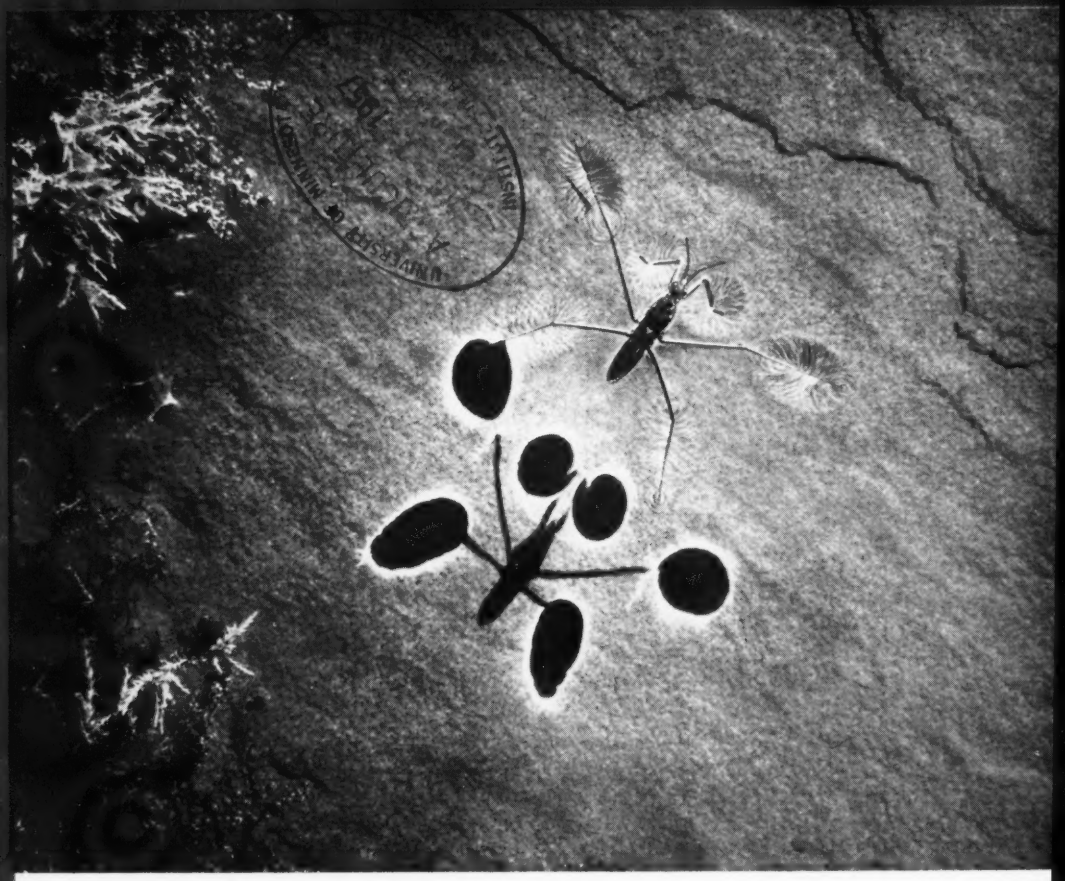
# A·I·B·S bulletin

## NEWS AND VIEWS IN THE BIOLOGICAL SCIENCES



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Vol. VII JUNE 1957 No. 3

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# CONTENTS

Everybody's Business ..... *C. W. Shilling* 9

The Fund for the Advancement of Education ... *John J. Scanlon* 12

A New Approach to Teaching Freshman Biology .. *James A. Peters* 14

To the Young Scientist on the Occasion of His First National Meeting ..... *Frank N. Young and Sears Crowell* 17

The Franz Theodore Stone Laboratory *Charles A. Dambach and Loren S. Putnam* 19

The Santa Barbara College Marine Biological Laboratory ..... *Demorest Davenport and D. K. Joice* 20

The New Orleans Conference of Biological Editors ..... *H. Bentley Glass* 21

Across the Editor's Desk ..... 25

From the Societies ..... 27

Education and Manpower ..... 28

Know Your Associates ..... 29

Advanced Registration for Stanford Meetings ..... 31

Letters to the Editor ..... 32

AIBS Reports ..... 33

Biology Library ..... 35

**Cover.** "Shadow and Substance". A water strider, showing the "dog-paw shadow" on the stream bottom and the "foot dents" in the water surface. Small air bubbles under the tarsal claws cause the star-like tip patterns. Photograph by H. Lou Gibson, 343 State St., Rochester, N. Y., President of the Biological Photographic Association.

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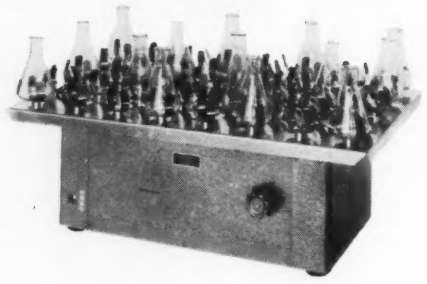

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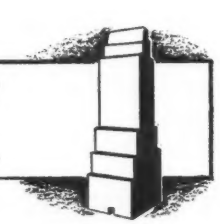

# Everybody's Business

**C. W. SHILLING, M.D.**

*Deputy Director, Division of Biology and Medicine, U. S. Atomic Energy Commission*

IN early days, warfare was strictly a gentleman's business. It was fought on a face-to-face basis with various types of hand instruments. Chivalry was the order of the day. Then came the long bow and the cross-bow and techniques for throwing rocks. With this development, the foe was no longer met in hand-to-hand combat. The advent of gun powder increased the distance from which it was possible to destroy the enemy. With the development of higher-powered guns, rifles, cannon and particularly with ships and planes to carry them, larger groups of combatants became involved and often the enemy was not even seen.

Then came more advanced bomb-type weapons, and the concept of attacking entire cities in addition to military installations. Civilian populations were now involved and it became everybody's business —in the city under attack. The advent of the atomic bomb in 1945 added power—from the standpoint of blast and heat and a larger circle of damage. And a new element was added by the radioactivity of the bomb components. With the larger bombs, came widespread radioactive fallout.

Nuclear war has now become everybody's business, for in the eventuality that this should happen, every person on the globe may be subject to radioactive fallout.

Every day we hear much about the dangers inherent in atomic power plants, the multiple uses of radioactive isotopes, the problems of disposal of radioactive waste, and last, but by no means least, the testing of atomic weapons. In short, radiation.

Some of the statements and misstatements about radiation are indeed disturbing and amidst the welter of differing opinions, it is not in the least surprising that the general public is not only confused but that some persons are very much alarmed. For these reasons, I believe it is time to repeat the known facts in a sober and scientific way.

Let us take a real look at the situation. The U. S. Atomic Energy Commission is doing everything within its power to find the anwsers to all of the many complex problems related to nuclear energy. In the Division of Biology and Medicine, there is a comprehensive research program inquiring into many facets of the effects of radiation on living tissue and the methods of preventing or alleviating these effects. This research program also includes extensive studies in genetics, in marine biology, in agriculture, in ecology, and even in meterology and oceanography.

In addition to the work carried on in our National Laboratories, the Division of Biology and Medicine sponsors 463 contracts with over 200 universities and nonprofit organizations and a few with industry. None of these contracts is classified in any way. The results are available in published literature. Other Divisions of the Commission also have research programs designed to advance the knowledge of use of the atom, in the Atoms-for-Peace program.

Operating out of the Division of Biology and Medicine and with the invaluable help of the Health and Safety Laboratory in New York City, is an extensive sampling program (part of a world-wide network) designed to determine the extent and amount of radioactive fallout. In addition, samples of water, soil, milk, plants, fish, foods, and bone, both human and animal, are collected from all over the world.

On the basis of known facts the Atomic Energy Commission has in the past made positive and, we feel, factual pronouncements. The first of these is that radiation has been with us for a long time—in fact, since the world began. Man didn't start it all with the atomic bomb!

This type of radiation is the natural "background" radiation that arises from the radioactive elements in the earth, cosmic radiation which comes to the earth from outer space, radiation from elements naturally or artifically radioactive, and man-made radiation, such as X-rays used in medical diagnosis and therapy.

About the first type: the crust of the earth contains radioactive material (particularly in granitic rock) amounting to an average exposure to the individual of about 40 milliroentgens per year from thorium, the same from potassium, and in addition, 20 milliroentgens from uranium and radium in the same granite. Since one of the natural potassium isotopes is radioactive and has a half-life of about one billion years, it is inevitable that the body contains some of this—and calculations indicate that we receive from this source, within our own bodies, about 35 milliroentgens per year. We must add to this about 35 more milliroentgens (at sea level) received from cosmic rays. At higher altitudes—for example, at 5,000 feet—65 milliroentgens per year are received from cosmic rays.

Radioactive material is thoroughly distributed over the earth. It has been estimated that a layer of soil one foot thick and one square mile in area will contain, on the average, more than one gram of radium, three tons of uranium, and six tons of thorium.

This background radiation varies in intensity depending upon the time of day, the altitude, the geology of the area or mineral deposition, and to a minor extent, the latitude. From these sources, background and cosmic rays, humans receive between 80 and 800 milliroentgens (0.08 to 0.8 roentgens) per year depending upon where they live. Measurements indicate that the variations between different inhabited areas of our globe is much greater than the intensity of the radiation from fallout to date. This natural or background radiation is reported to amount to 4.3 roentgens to the gonads during the reproductive lifetime, which is statistically calculated to be from conception to age 30 years (National Academy of Sciences—National Research Council, "The Biological Effects of Atomic Radiation — Summary Reports" June 1956).

To this amount of radiation must be added what man contributes to the total in the use of X-rays and the fluoroscope. The amount of diagnostic radiation to which a patient is exposed may be many hundred times that which he receives from background, but even so is not considered by the medical profession to be hazardous. It must be noted that these exposures usually only involve one part of the body and not the entire body. Let us look at some of the typical X-ray examinations and the amounts of exposure involved:

Routine chest X-ray.....0.04 to 1 r. per exposure

Routine gastro-intestinal X-ray.....1.0 r. per exposure

X-ray of extremities.....0.25 to 1.0 r.

Fluoroscopic examination .....10 to 20 r. per min.

Cinefluorography (X-ray movie).....25 r. per examination

This man-made radiation is calculated to amount to 3.0 roentgens during the reproductive lifetime of the average American.

It should be remembered too, that *treatment* with X-rays, radium or cobalt 60 may be several orders of magnitude higher than for diagnostic purposes. For example, a skin cancer may be exposed to 4,000 r. of X-rays of relatively low energy with little or no effect on the patient except for the destruction of the cancer cells and a little scarring of the adjacent tissue. On the other hand, a single exposure, amounting to only one-tenth that amount of penetrating X-rays given simultaneously to all parts of the body, would most likely result in death to one-half of the persons so exposed.

What is the situation relative to fallout from the test detonation of nuclear weapons? — another man-made factor that we must consider.

First, what is *fallout?* Commissioner Libby said in June of 1955:

"Radioactive fallout is the radioactivity which falls out of the atmosphere after the explosion of a nuclear weapon. The nuclear reactions furnishing the energy in atomic and thermonuclear weapons produce radioactivities as end products. In the ordinary atomic bomb, for each 20,000 tons of TNT equivalent, about two pounds of radioactive materials are produced. In these two pounds are some ninety different radioactive species, varying in natural lifetime from fractions of a second to many years. The mixture as a whole decreases in radioactivity in such a way that for every sevenfold hourly increase in age, the radioactivity is decreased ten-fold. Thus, the radioactivity seven hours after the explosion has decreased to 1/10 the radioactivity at one hour; at 49 hours (roughly two days) to 1/100; at two weeks to 1/1000; and at three months to 1/10,000.

"The conditions of fallout, of course, are largely determined by the amount and type of material vaporized into the fireball of the bomb itself. A bomb fired in the air contributes such a small amount of matter to the cloud that the particles are of necessity very tiny and very slow in settling. The result is that most of the radioactivities are expended in the air and the area of dissemination is very large indeed, usually extending to the ends of the earth in minute though detectable amounts.

"A bomb fired on the surface of the earth, however, may have a major portion of its radioactivity reprecipitated within short distances. In fact, bombs fired beneath the surface of the earth may place essentially no radioactivity in the atmosphere. So, the question of the area of contamination to be expected from atomic and thermonuclear weapons cannot be answered categorically without specifying the degree of contact of the fireball with the surface of the earth, and probably also the chemical characteristics of the surface."

In all of the considerations concerning radioactivity and its effects on human beings, we must carefully distinguish between radiation outside the body, i.e. external sources, and radiation from sources within the body resulting from the ingestion of radioactive material—by breathing it in or swallowing it.

First, external radiation. What is the external dose rate to the average individual in the U.S. from fallout material? From the best figures obtained from direct measurements at a large number of monitoring stations and from analysis of a variety of collected samples, the AEC's recent Twenty-first Semiannual Report to the Congress states:

"The range in values of maximum possible accumulated gamma doses to date for localities in the United States outside the vicinity of the Neveda Test Site is 0.006 to 0.049 roentgen (except three cities, Albuquerque, N. Mex., with 0.11, Grand Junction, Colo., 0.12 and Salt Lake City, Utah, 0.16) while foreign stations range from 0.004 to 0.023 roentgen (except some of the Pacific Islands which range from 0.013 to 0.15)."

However, it must be noted that with continued testing and from such additional sources as particle discharge from atomic processing plants, from power plants and from waste disposal into the air, land, and to some extent the sea, there will continue to be a slight but perceptible rise in the level of environmental radiation to which man will be exposed.

The National Academy of Sciences report, "The Biological Effects of Atomic Radiation," indicates that the amount of radiation to the gonads, if testing is continued at the level of the past five years, probably will amount to 0.1 r. for the average person in the U. S. during his reproductive lifetime.

In the problem of internal emitters, i.e., the isotopes that are retained when taken into the body and continue to give off radiation, strontium 90 is by far the most important.

Because of its resemblance to calcium, strontium 90 is assimilated by biological processes. If ingested by humans, in food or water, the strontium will deposit, like calcium, in the skeleton. At a distance from the explosion site, the only significant radioactive fallout isotope is the strontium 90.

There are several reasons for this. First, is its long half-life of 28 years; another is its chemical similarity to calcium. Another is its bone-seeking propensity. In large enough amounts, inferential evidence points to the probability that it may cause leukemia or bone tumors. This is undoubtedly its most significant effect. It has been reliably estimated that the dose to the gonads from strontium 90 is but 1/40 of the dose to the bone.

According to quantum theory, the probability exists that a single ionizing event may kill or injure a living cell. This type of event is difficult to demonstrate in multiple-celled organisms such as man, but an easy task in single-celled microorganisms. An injured or mutated cell could continue to divide and thus give rise to groups of abnormal cells, which, under certain circumstances, might lead to cancerous cells. One reason that the effect of small amounts of radiation cannot be detected is that there is almost immediate repair of damaged tissue by the organism. Another reason that detection is all but impossible is that there are 2,000 ionizing events per cubic centimeter of our bodies occurring every second of our lives from natural sources. It is, therefore, difficult to believe that the addition of one more, making it 2,001, would make a detectable difference. Doubling i.e. 4,000 per second per cubic centimeter—yes—but not one extra.

Let us take a moment to examine this somatic effect when radiation is delivered externally in overwhelming quantities, such as the gamma radiation in the immediate vicinity of a nuclear detonation.

Dr. John Bugher, past Director of the Division of Biology and Medicine, AEC, has said:

"The immediate effects of whole body gamma radiation are determined by the dosage received and the rate of delivery. The systems most fundamentally affected are the central nervous system, blood forming organs and tissues and the gastro-intestinal tract. For radiation promptly delivered, transient depression of white blood cells and platelets may be detected at an exposure of 50 roentgens and nausea and vomiting will occasionally be found with whole body doses as low as 100 roentgens.

"Where the dose is delivered over periods of weeks to months, the total amount of radiation received before there is recognizable change is many times the dose that is lethal when delivered within a few minutes. Where exposures of several hundred roentgens occur, it seems clear from the results of the study of the survivors of Hiroshima and Nagasaki that there is an increase in the frequency of leukemia. The increase is marked only in proportion to the normal frequency of the disease. The actual number of all such cases will be detectable only when a large population is studied. From heavy doses of gamma radiation, it seems possible and perhaps probable that there will be a statistical shortening of life expectancy, again to be appreciated only by the most meticulous study of a large population. Such factors require hundreds of roentgens to be increased detectably and we see no possibility whatever of recognizing such effects at the exposure levels from radioactive fallout from tests."

We have seen in animal experimental work, following exposure to large amounts of radiation (enormous when compared to fallout), that there is an increase in the incidence of cancer, there is an aging effect and there is definite life shortening, but this is with exposures thousands of times greater than the average received from all fallout from 1945 to date.

A careful study has been made of the Rongelap people who were exposed to fallout during the Pacific test series in March 1954. Some of the exposed persons received as high as 175 r. However, medical follow-up to date has indicated that, aside from some skin scarring from burns resulting from direct contact with fallout particles, the general condition of their health is good and no untoward effects, which might have been expected, are evident in them or in children born since the incident.

Next, let us turn to what is known about the effects of radiation damage to the germ cells giving rise to alteration of the genes upon which inheritance depends.

Dr. Warren Weaver, speaking as Chairman of the Committee on Genetic Effects of Atomic Radiation of the National Academy of Sciences, in a statement before the Congress recently, said in this connection,

"Now what we do know about the effects of radiation, the genetic effects of

radiation, in all briefness and simplicity, is this: We know that radiation causes what the geneticist calls mutation, changes in the actual genes and chromosomes which control our heredity. We know these mutations as caused by radiations are in practically all cases harmful. Certainly, 95% of mutations are harmful. Very probably 99% and perhaps even a higher percentage. We do know that the number of mutations is proportional to the total amount of radiation which the individual receives, and I mean the total accumulated amount from the time he is conceived up to the time of the conception of his last child. This is the part of it which is genetically important. If a certain individual is not going to be involved in the conception of any further children, then obviously what happens to him is of no longer any genetic significance."

Dr. Earl Green, one of our foremost geneticists, testifying before the Congress concerning the genetic problem, said:

"Genetic experiments with animals suggest that for a billion genes about 5,000 will mutate spontaneously or without assignable cause in each generation. If the billion genes are exposed to 1 unit of radiation (i.e., 1 roentgen), about 100 to 200 more genes may mutate. The average level of radiation from all tests of atomic weapons to date is about one-tenth of this unit of radiation. Thus, instead of 5,000 mutations, there may have been 5,010 or 5,020 mutations in a billion organisms. It should be reemphasized that these estimates may be either too low or too high, since they are based upon animal experiments."

The AEC Advisory Committee on Biology and Medicine made the following official statement (May, 1955) which has a definite bearing on the genetic problem:

"Experiments on animals and plants and observations on man show that mutations occur spontaneously at all times. Most of these mutations act unfavorably on the development, growth or well-being of individuals. The spontaneously mutated genes have accumulated in large numbers in all human populations. Their presence accounts to a considerable extent for the fact that at least one percent of all new-born exhibit developmental abnormalities, most of them to a very slight degree but some in a more serious way.

"Irradiation of animals and plants adds to the number of more or less detrimental mutations. Human genes must be considered as being equally subject to the mutagenic effect of radiation. Indeed, a considerable fraction of the so-called spontaneous mutations of man are probably caused by the natural background irradiation from cosmic rays, soil and food.

"The radiation produced by fall-out from atomic weapons tests as well as from present and future peaceful applications of nuclear energy will result in additional mutations in human genes. The number of these cannot be estimated accurately at this time. At the current rate of irradiation from fall-out, among the four million children born each year in the United States, perhaps from a hundred to several thousand may carry as a result of this irradiation a mutated gene. At most, only a small percentage of these genes will produce any noticeable effect in the first generation. Only slowly, over hundreds of years will the majority of these radiation-induced genes become apparent, in a few individuals at a time, usually by causing a less than normal development or functioning of the person concerned. It will be impossible to identify these individuals among the large number of similar ones, affected by genes already present in the population due to accumulated spontaneous mutations.

"No measurable increase in defective individuals will be observable at any time as the result of current weapons' tests, since the few radiation-induced defectives will not change measurably the number of about 40,000 defectives who will occur spontaneously among the four million births of each year in the U. S. It may be pointed out that no significant change in the percenteage of malformed children has been observed among those conceived after the war whose parents had been exposed to the atomic bombs in Hiroshima and Nagasaki.

"The foregoing conclusions apply only to the gentic effects of weapons' tests carried out at the present level and of foreseeable peacetime uses of atomic energy. The genetic effects of a generalized nuclear war would be one of many castrophic consequences of such a disaster."

Dr. Warren Weaver, in 1956, said:

"A fallout dose of 0.1 roentgens is, for example, only 1/100 of the 10 roentgens set as 'reasonable' by the National Academy of Science report. It is only about 1/500 of the dose that would presumably be required to double the natural rate of mutation. If I am already running a certain risk (and after all surviving in spite of it) then ultimately to add to this risk by only one part in five hundred, does, when put in this relative way, seem pretty negligible.

"But look at the question in other terms. At the present time, roughly 4.5 per cent of the babies born in the United States have serious defects (congenital malformation, mental defects, epilepsy, cutaneous and skeletal defects, visual and aural defects, etc.). Of these, it seems likely that about half are genetic in origin. Let us roughly assume that 2% of the babies born have defects of mutational origin.

"Now all the persons now alive in the world—all the persons who at this moment face this problem—will have, before they are all dead, something of the order of fifteen thousand million babies ($1.5 \times 10^9$). The immediate genetic risk to this vast set of babies—the world's next set of persons—may well be increased, due to fallout, only one part of 5,000* ($2 \times 10^{-4}$). The increase in risk is very small but the increase applies to a vast number of persons. The estimated result, in fact, is 6,000 additional handicapped babies. Now what impresses you as more significant—that 6,000 is a good many babies to subject to serious handicap, or that 1/5000 is a very small fraction and correspondingly is a very small relative addition to the thirty million babies that, without fallout, will have serious genetic handicaps?"

Dr. Weaver uses a figure of 4.5 per cent defective, while others use figures as low as 2 per cent and some even 1 per cent. So the figure of defective offspring that can possibly be chargeable to fallout may be 2666 or 1333 instead of 6,000. No wonder many scientists have said it would be impossible to demonstrate any increase due to fallout from testing.

We now have a conspectus of views from many different authoritative sources. What central points of agreement do we find?

It is obvious that everyone agrees that radiation alters cell structure. There seems to be general agreement also that, from the somatic or individual standpoint, an exposure of 100 r or more may result in demonstrable body changes such as leukemia in a small percentage of the individuals. There also seems to be general agreement that from the somatic standpoint, there may be repair of tissue and a return to apparent normal health.

What agreement do we have concerning the genetic effects? Once again, authorities agree that radiation damages germ cells. There is also general agreement that the resulting mutations transmitted by these changed cells are deleterious. There is also general agreement that the effect of radiation is proportional to the amount received and is cumulative. There is fair agreement as to the order of magnitude of the damage likely to result from radiation from various sources. There even is reasonable agreement as to the amount of damage which may result from the contamination due to fallout.

Now, let us look at some of the other factors which must be brought into focus. From the genetic standpoint, the figures quoted by Dr. Warren Weaver relative to the number of possible deformities, speaks only of first generation damage; however, mutations can be carried forward into subsequent generations. On the other hand, it must be pointed out that there is a tendency for deleterious or harmful mutations to be eliminated. This is due to the fact that in many cases, the harmful effects lead to lessened fertility and thus to fewer offspring, and may also lead to life-shortening and in some cases death before offspring are produced.

We also must bear in mind that there was at least as much radiation on this earth when life was but a single-celled organism on the floor of the ocean as there is now. Yet through millions of years of transition, life has progressed to its present state. Therefore, the addition of a small amount of radiation at this stage from fallout is not

* This factor is the product of 1/500 (a reasonable ratio of fallout to the doubling dose) by 1/10 (a reasonable estimate of the fraction of total damage which would be expressed in the first generation).

likely to cause either the immediate or the future destruction of the human race, particularly when we realize that fallout due to weapons testing is an order of magnitude divided by 4.3 less than normal background radiation to which we have obviously made an adjustment.

Admitting that there are some risks and admitting that radiation is adding slightly to the genetic burden that the human race carries, we then are in a position of having to determine whether this risk is one that should be taken. Dr. C. L. Dunham, Director of the Division of Biology and Medicine, AEC, in an address delivered July, 1956, at Denver, Colorado, summed up the problem:

"It is, of course, this injurious effect of radiation which makes it essential that all unnecessary exposure to ionizing radiation be avoided. To put it another way, there should be *no exposure of persons to radiation without at the same time some useful purpose being served for the individual or for the group.* In fact, we should go one step further as has been recently urged in the report of the National Academy of Sciences-National Research Council on the biological effects of atomic radiation. Even when a useful purpose is served, whether in industry, in national defense, or in the practice of medicine, all radiation exposures should be kept at a minimum, especially exposures to the germ cells."

Obviously, the risk from the ever-present background of radiation has to be taken. It seems obvious too that we must take our chances with the medical use of the X-ray and by-products of atomic energy, both for diagnosis and treatment. I would urge, however, that the roentgenologist become thoroughly familiar with this problem and use X-ray as sparingly as possible.

The next question we must face and must answer is, must we continue to live with radioactive fallout? To this, the answer is "yes" at least until a safeguarded system of international disarmament is worked out. Until such time we must continue testing of the various types of nuclear weapons not only to study their characteristics, but also and perhaps more importantly, to study ways and means of protecting populations from their effects should they ever be used in warfare. The game we are playing with Russia is for enormously high stakes and is for keeps. Therefore, we must gamble with the probability of radiation damage to a few individuals in order to secure the survival of the total society.

Then we must turn to the problem of atomic power to be generated by nuclear reactors. Once again, one reads radically conflicting statements. Some facts, however, can be incontrovertibly stated. The world supply of fuel is not inexhaustible. Some areas of the world are in dire straits now. Cheaper power would undoubtedly revolutionize the civilization of many areas of the globe. Better living conditions would definitely follow.

We know that the risk of accidental release of radioactive contamination from reactors is extremely low. Surely, there is some risk, just as there is some risk in any kind of industrial operation. The atomic energy program has an excellent safety record in its operations to date, and there is every reason to believe that, under the safeguards in effect, this good record will continue as the atomic power industry develops.

On the credit side, in addition to national protection, and the development of power, we must not forget the incalculable benefits derived from radio isotopes. It has been estimated that the use of radio isotopes in industry already is resulting in cost savings of $295 million to $485 million annually. This does not count the enormous advancement of the frontiers of knowledge through the use of radio isotopes in research, nor does it count the value to humanity in the diagnosis and treatment of disease.

Let me call attention to the fact that by the very nature of our essential freedoms, everyone has the right to talk and say what he wishes. This means, in our system, that the cog wheels are loosely meshed together and make a good deal of noise as the machine gradually grinds out the truth concerning, in this case, the balance between the risks and benefits to be realized by the use of atomic energy.

So, it seems to me that it would be well for all of us to be as calm as possible in the presence of the revolution that atomic energy must inevitably bring to our way of life. Let us not strew the road with tacks as some fanatics did in order to stop the progress of the automobile.

# The Fund for the Advancement of Education

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IN THE spring of 1951 the Ford Foundation established the Fund for the Advancement of Education as an independent organization to support new and experimental programs at all levels of formal education. During the past six years the Fund has concentrated on five problems which seemed of major importance: 1) equalization of educational opportunity, 2) improvements in curricula, 3) clarification of the functions of educational institutions, 4) improvement of educational management and financing, and 5) the improvement of teaching. Our grants and expenditures to date have totaled more than $40,000,000, of which nearly two-thirds has been devoted to the improvement of teaching.

Year by year the Fund has tried to concentrate on problems in these areas made urgent by the particular circumstances of education.

Equalization of educational opportunity, for example, received particular attention in 1953 when a study of bi-racial aspects of public education in the United States was made in anticipation of the impending legal decision on the constitutionality of segregation. The findings were summarized in *The Negro and the Schools*, published fortuitously the day before the Supreme Court handed down its decision in May, 1954. As an outgrowth of this decision, the Fund established the Southern Education Reporting Service to facilitate communication between various communities and states, and to help state and local school administrators meet the many complex problems raised by the decision. These are but two examples of the Fund's activities in this field. Others include grants to the New York public school system to improve the educational opportunities of Puerto Rican students and a program of scholarship aid to economically underprivileged students in New Mexico.

Improvements in curricula have been prompted mainly by past and prolonged neglect of the able or gifted student. A prime example of curriculum enrichment is found in the Portland (Oregon) project in which public school teachers have been working with faculty members of Reed College to develop courses considerably more demanding and rewarding than those designed for the average student. Not only does the program provide for many kinds of creative, artistic, and intellectual ability, but it trains teachers to develop and experiment with new methods, it coordinates the special course and its teachers into the regular program so that all may benefit in some measure, and it encourages cooperation with the colleges to effect closer articulation with the high school programs. One of the most important aspects of the Portland program is the fact that a large city system has recognized the need for providing adequate educational opportunity to superior students and has adopted a program for this purpose as a regular part of its educational system. The Early Admission to College Program, set up in 1951, offers superior high school students the

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opportunity to progress at their own rate of ability by entering college either after their sophomore or junior year in high school. The Advanced Standing Program, now administered by the College Entrance Examination Board, provides a means by which superior students can take college-level courses while still in high school and can enter college with advanced standing.

Because of a renewed appreciation for liberal arts education in the past 20 or 30 years, many colleges are trying to redefine their role in American life and fill it more effectively. A college cannot measure the success of its goals and aims unless those aims are first clarified. In 1952 and 1953 a total of 37 colleges received support from the Fund for self-study programs which sought to re-examine objectives and analyze the relevance of classroom and other practices to them. Each college oriented its self study in a different way. One of the most intensive studies has been carried out by the University of Pennsylvania, where numerous faculty committees assisted by a central study staff analyzed the entire educational program in an attempt to relate the work of each department, course, and instructor more directly to the University's chief objectives.

In the area of educational management and finance, the Fund has tried to help colleges and universities make the most of their available resources by providing part of the costs of about 30 management surveys. Each survey has concentrated on different aspects of management ranging from a major reorganization of the central administration to improved practices in building and grounds management. At the University of North Carolina, for example, the survey resulted in more effective coordination among the several branches throughout the state and in extensive changes in the by-laws of the University. One small liberal arts college fund that it could accommodate a considerably higher enrollment than had earlier been supposed. The president of a large university estimated that the savings from the survey would approximate $800,000 during the first year. In almost all cases, presidents reported that the actual savings during the first year after the survey equaled and in some cases exceeded the original cost of the survey.

The projects described thus far have highlighted four of the areas in which the Fund has been active. However, it is in the fifth area—the improvement of teaching—that there has been the greatest need and most opportunity for supporting experimentation. The critical shortage of teachers at all levels is one of the most urgent problems confronting education today, and it will continue to be acute for the foreseeable future. By 1965 elementary enrollments will have increased 32% and secondary enrollments will have increased 74% over 1954. There will be twice as many college students by 1966 as there were in 1954. To accommodate these huge enrollments and at the same time improve the quality of education presents a challenge which will require drastic changes in the present pattern of teacher recruitment, preparation, and utilization. Consequently, the Fund has devoted a major share of its resources to experiments in this field.

In order to tap an important new source of able teachers—younger and older liberal arts graduates who have had no undergraduate courses in education—the Fund has supported a variety of "fifth-year" experiments at 22 colleges and universities (plus 50 more related colleges). These programs, though differing in many details, generally emphasize the internship experience and the integration of theory and practice through seminars instead of conventional types of professional courses. Some of these programs are designed for older liberal arts graduates, e.g., mothers whose grown children no longer need full-time care. Others are designed for recent liberal arts graduates. Several of them depend heavily for training teachers on the public schools themselves, with the guidance and cooperation of neighboring higher educational institutions.

To broaden the education of future college teachers, the Fund has supported several graduate school experiments at Stanford University, Vanderbilt University, Emory University, and the Claremont Graduate School, involving "inter-departmental" curriculum arrangements and supervised teaching experience. The most extensive program for college teachers, however, has been the College Teaching Internship Program, designed to orient the beginning instructor to full-time teaching more effectively and help him do his best teaching early. More than 20 institutions have participated in this experiment. Typically, each intern is assigned to an experienced "master" teacher who observes and criticizes his teaching, while the intern, with a reduced teaching load, attends periodic seminars, reads, learns about the college as a whole, and observes the master teacher at work in his own classroom. As a result, the beginning instructor gets a much more meaningful and fruitful induction into the art of teaching. Evaluation studies show that all of the participating colleges, master teachers, and instructors are enthusiastic about the results. The colleges plan to expand the program largely at their own expense and ultimately with no outside support.

The Fund also has been concerned with upgrading good teachers already on the job, not only to stimulate them intellectually but also to encourage them in assuming greater leadership roles in improving their own high schools and colleges. Toward this end, fellowship programs for high school and college teachers were designed to broaden the education and experience of the teacher and to give him a better perspective of his own field in relation to other fields. Over a five-year period, 1,119 college teachers and over a four-year period, 919 high school teachers received a full-year fellowship equivalent to their regular academic salary plus an allowance for travel and related costs. Reports on these teachers after they returned to the classroom indicated that not only were most of them better teachers of their own courses, but many brought back fresh ideas for improving their institutions and displayed marked leadership among their colleagues.

Many schools and colleges across the nation are conducting experiments to help teachers increase their effectiveness and reach more students. Underlying these experiments is the conviction that if the major forms of manpower waste in education could be sharply reduced—if all teachers were freed of the burden of non-professional chores and allowed to make full use of their unique talents, if the best teachers could reach more students, if the curriculum were stripped of non-essential courses which have burgeoned because of faculty interest rather than student need, and if the power of students to learn much for themselves could be fully released—if all these things could be done, then teachers could command the prestige, status and rewards that characterize other professions. And what is more important, educational quality and enrollments could rise together.

Approaches to greater efficiency in education may take several forms, and the Fund has supported a number of them. Perhaps the greatest concentration has been on the varied uses of television as a teaching medium. At Stephens College in Missouri, for example, all entering students take a course in general education built around closed-circuit television lectures by an outstanding visiting scholar. The students are in small groups in 50 classrooms, and after each lecture faculty members or advanced students lead the classes in discussion. At Fisk University in Tennessee, a three-year experiment is underway involving closed-circuit television lectures in chemistry, physics, modern languages, psychology, and child development; small study centers or "colleges" headed by outstanding teachers; and the development of a communications laboratory. At Pennsylvania State University, closed-circuit television is being used to teach courses in chemistry, psychology, education, economics, music, speech, air science, elementary business law, elementary accounting, history of art and architecture, mathematics, and zoology. In addition, a study is being made of the comparative effectiveness of various methods of television teaching, the practicality of television in terms of management, equipment, operation, cost, and acceptability by students, faculty and the administration.

One of the most unusual television experiments is being undertaken by the Texas Education Agency. As part of a state-wide program to recruit more able young people into teaching, an open-circuit television course in professional education is being offered for credit to several hundred liberal arts graduates throughout the state who will be teaching on a temporary permit while they are working toward permanent certification.

At the elementary and secondary levels, a comprehensive television experiment is

being carried on in Hagerstown, Maryland, in the Washington County Schools. Eleven basic courses are being taught over closed-circuit television to 6,000 students ranging from grades 1-12 in eight schools during 1956-57. Next year the experiment will be broadened to reach 12,000 pupils, and during the following year, the 18,000 students in all 48 of Washington County's public schools will receive television instruction. Television also will be used for in-service training of teachers, for interpreting the program to interested public groups and improving the quality of the school program.

Other Fund-supported experiments in the better utilization of teaching resources involve the use of films, tape-recorders and other devices for extending the effectiveness of top-quality teachers; the use of older and more advanced students to participate in the instruction of younger ones; the use of college-educated faculty wives and other mature liberal arts graduates as teaching assistants; curriculum revision to weed out "fringe" courses; and re-examination of the whole question of class size and student-teacher ratios in relation to the quality of education.

At Johns Hopkins, for example, filmed lectures by scholars of the highest competence in their fields will be planned, produced, and distributed to fifty undergraduate colleges throughout the country for classroom use and evaluation. This project envisions the eventual development of a "Film University of Great Teachers," available to college students throughout the country.

At Lehigh University, the curriculum in the engineering college will be completely reorganized to eliminate duplication in courses, staff, and laboratories. The new curriculum will be built around engineering divisions (thermodynamics, structural-machine design, etc.) rather than the present departmental divisions (mechanical engineering, civil engineering, electrical engineering, etc.).

Harvard University is developing and testing ten mechanical self-testing devices in language and science. These devices, designed to require creative thinking rather than rote answers, will enable the student to measure accurately his own progress by letting him know whether each response is correct or not before he goes on to the next question.

In Bay City, Michigan a five-year "teacher aide" program has been operating in eight elementary classrooms each with 45 to 52 students. The master teacher in each classroom is relieved of non-professional or routine duties by a carefully selected aide. The aide's duties include taking roll, collecting milk money, rearranging desks, keeping records, checking papers, and supervising recess. Encouraging results have prompted expansion of the experiment to several nearby school systems.

The problems posed by rapidly rising enrollments and a critical shortage of teachers will not be easy ones to solve, but it is the Fund's conviction that they can be solved by bold, imaginative action and a willingness to critically re-examine traditional ways of doing things. The challenge is a great one, but if it is met with the same ingenuity that characterizes other phases of American life, the quality of education can rise to new levels in the decades ahead. The Fund's role in helping our schools and colleges meet the challenge is one of seeking out and supporting promising lines of attack.

# A New Approach to Teaching Freshman Biology

**JAMES A. PETERS**

*Department of Biology, Brown University*

ARE we, as biologists, doing all we can to make sure that our science attracts the best possible candidates for the jobs of the future? Or do we, at the earliest possible level, set up a double standard of operation, one for professionals and one for neophytes? This double standard states, in effect, that biologists who are professionally active in the field must, of necessity, work in a different fashion than a beginner. Every biologist focuses his attention on an area of biology that interests him personally, and maintains this interest by reading and doing active research in the parts of that area that are living and controversial, not dead and dried. He uses textbooks primarily as references, not as "required reading." He resents any attempt at dictation as to his research interests. It is impossible to assign him a topic outside his area of interest and expect him to prepare a review paper on that topic. He thrives on thoughtful discussion, intelligent analysis of research, the testing of hypothesis, and the organization of experiments.

What of the undergraduate, taking his first biology course? How much of the "fun" of biology does he experience? He usually finds his attention focused upon an area of biology of interest to his professor. He has little or no opportunity to develop an individual area of interest, since the pressure to keep up with the professor is too great. His instruction is often designed so that he is unaware of the controversial topics in modern biology. His knowledge comes almost exclusively from textbooks, in which explicit assignments are made. His interests are completely dictated to him. Topics for term papers are assigned. He has no opportunity for discussion of any sort, and seldom if ever finds it necessary to analyze research, test hypotheses, or organize an experiment.

It is my contention that our first-year biology students, both concentrators and nonconcentrators, should begin with a course designed to give them as complete a sampling as possible of all the pleasures of the biologist mentioned above. He should be allowed to experience independence, both in his approach and in his thought. Concomitant with this independence, he should learn responsibility—the responsibility that springs from being forced to dig out his own facts and background.

## IC Curriculum

In the fall of 1953 Brown University began a new, experimental approach to the problems of freshman instruction. This program, undertaken through the aid of a grant from the Carnegie Corporation of New York, has come to be known as the "IC" curriculum. The name is derived from the general title of the program, The Identification and Criticism of Ideas. The courses were originally conceived by the late Bruce Bigelow, organized and formally introduced by the great past president of Brown, Henry Wriston, and implemented by the Dean of the College, Barnaby Keeney, now president of the University. The courses are designed to revitalize the first two years of college by a thorough reorganization of both approach and content, removing thereby the remedial nature of introductory college courses. Responsibility for the accumulation of knowledge is shifted from the professor to the student. Emphasis is placed upon familiarity with

the original sources of ideas in a field of study, so textbooks are no longer used. The development of an individual, independent viewpoint on the part of each student as a consequence of freedom from formalized course content is of paramount importance. Growth of the ability to evaluate, analyze, recognize, and, when necessary, constructively criticize independent thought and original contributions is implicit in the course approach. Active, competent participation in the formulation and articulation of ideas and evidences derived from independent investigations is required, and, as a consequence, professional lectures are abandoned in favor of discussion groups.

Courses were organized originally in twelve departments, later in two others, and are now offered in fifteen different departments. All are two-semester courses, and in all departments are focused on original sources and classic expression of vital ideas. Thus, freshmen in the Economics Department start their reading with Adam Smith's "Wealth of Nations," students in psychology begin with the writings of Pavlov and Freud, and those in philosophy face Plato's "Republic." The program may sound familiar to some who have followed trends in education, but in this regard the "General Catalog" of Brown University states, "In the use of primary sources and the small discussion class, the new courses have features in common with many 'general education' courses introduced in the recent past at other institutions. The Brown program is radical in its intensive concern with the central text, and in the subordination of topical coverage to the development of critical judgment at this early stage of the student's career."

The Biology Department, under the chairmanship of J. Walter Wilson, has participated in the program since its inception. During the first two years, Darwin's "Origin of Species" was used as the central source about which the course revolved. At the end of the second year, it was decided that the primary strength of the course came from the inclusive nature of the theory that was the central part of Darwin's work and not from the fact that it was a single source. To test the validity of this decision and to carry the experiment still further, the course was revised so that the student followed the development of a given theory directly in the journal literature. It was obvious that any biological concept which was fairly all-inclusive in nature would be satisfactory, such as the theory of evolution or the cell theory. The theory of the gene was finally selected, in large part because its beginnings in Mendel's paper are so clearly defined. Thus, for the second two years of the program, biology students have first read Mendel's original paper as translated by Bateson, followed by works such as Sutton, "The Chromosomes in Heredity"; Hardy, "Mendelian Proportions in a Mixed Population"; Muller, "Variation Due to Change in the Individual Gene"; and many others. They are brought up to the present by reading Stadler's 1954 paper, "The Gene," and Sturtevant's work in the same year, "The Social Implications of the Genetics of Man."* The emphasis in the course is not on genetics as an isolated biological discipline, however, but rather on the relationship that knowledge concerning hereditary mechanisms and controls has with all other biological knowledge, as well as with other thoughtful disciplines, such as sociology. The student in the Biology IC course is given comparatively free rein in his accumulation of knowledge concerning biology. There are two primary stipulations placed upon him, however. The first of these requires that the student must develop a familiarity with the concepts that are basic to thought in that field of biology which receives his attention, such as physiology, biochemistry, ecology, and so on. The second requires that he determine what effect thought and research in that field of biological work has on the theory of the gene and what effect the theory of the gene has upon the selected field. This, of course, provides an area of coordination and synthesis to which each individual student can uniquely contribute in the discussions, and gives the class as a whole a feeling for the unitary nature of what appears to be a highly splintered science.

## Course Operation

The mechanics of the course involve the use of discussion periods, laboratory sessions, research papers and, occasionally, research projects. The core of the discussion period has been consistent in nature, but several variations on this core have been used. Of primary importance to this work is the role of the instructor. He alternates among the roles of authoritative guide, program director, silent listener, and master inquisitor. The roles are played in approximately that sequence through the year. The instructor is present primarily to see to it that biological fact is not avoided or disregarded, that the discussion does not ramble from generality to generality interminably, that a point is not dropped short of a valid conclusion simply because the class is temporarily satisfied, and that the bearing of a fact from one area upon an idea in another is emphasized.

During most class sessions, the entire class participates in a single discussion. The instructor maintains close control over this group to permit greater participation through selection of individuals, and to make certain that a particular topic is covered thoroughly. On occasion the class is split into three or four groups of five or six people, and each group discusses current work independently, followed by general class discussion of their results. This permits more individual participation and is very helpful to slow starters. Occasionally, a "panel" is selected from the class, which then becomes solely responsible for the discussion, with the remainder of the class as an audience. The panel discussion is conducted in two ways. In the first method, one part of the panel becomes the authority on a topic, the other part acts as questioners on the topic. The second method is to select a controversial point as topic and divide the panel into a debating group. After a period of time, the rest of the class is allowed to work over the panel's results. On still other occasions, a student has been delegated the job of conducting the discussion, while the professor refrains from participation.

If a point comes up that appears to be of interest to the class, but it is obvious that no one has any information concerning it, an individual is assigned the point as the subject of a short report, usually given at the next class meeting. After a full year, each student has given at least one such report. Any such point not assigned is left as a class responsibility and is usually checked at the next meeting to see if any additional information is forthcoming.

The laboratory work is designed with several purposes in mind. First, it is necessary that the laboratory perpetuate the philosophy of the shift of responsibility to the student. To do this, the "cook-book" laboratory manual is eliminated. The student is told what the general purpose of the laboratory session is, e.g., the study of mitosis and meiosis, and then is told what study materials will be available, such as sections of ripe *Ascaris* uterus or of onion root tip. Two or three leading questions to indicate the general approach to the work are then given, and the rest is up to the individual. There is room provided for questions the student evolves during his work, and for observations, notes, drawings, and so forth (all encouraged solely as aids to learning rather than as points for examination and evaluation). In addition, each student is required to draw up a list of the conclusions which he has personally formulated as a consequence of the work done, within twenty-four hours of the laboratory session. This is designed primarily to induce thought concerning the work done and to force the correlation of unrelated facts into a meaningful whole.

Research papers are assigned at regular intervals, usually far enough apart to permit thorough and adequate preparation. Free selection of topics is permitted, with the stipulation that no paper can be strictly descriptive in nature. Each paper is expected to deal with a subject that permits the introduction of original data and evidence, and that involves thoughtful analysis and interpretation of these data. Original literature must be used in the preparation of the paper, and the student is expected to become familiar with and use the various abstracting and recording services available to biologists. The papers are unrestricted as to length. Several papers can be prepared on closely related topics, but no student is allowed to prepare all papers on a single area of biological thought.

## Virtues of the New Teaching Methods

The IC course in biology gives the student an introduction to the field of biology

* A complete list of the papers read is available upon application to the author.

as an entity in itself, it introduces him to a scientific discipline, it provides him with a background for continued work in the field, and it gives him a feeling for what biologists are trying to achieve. Any competently taught introductory course will do the same things, however, and the "IC" approach becomes fruitful only when it provides more than this equivalent material.

As presently set up, the course allows each student the opportunity to attain the maximum of achievement, with concomitant recognition, of which he is capable. The elimination of a maximum limit (i.e., thorough familiarity with a particular set of lectures, or a specified textbook, and so on) permits the student to exhibit maximum ability, and gives him maximum challenge. The excellent student is forced to expend as much effort in preparation as the mediocre one, and his total attainment is consequently greater than under ordinary circumstances.

The course permits the instructor to detect differences in types of excellent students. Thus, while a standard course tends to lump students strong in memorizing ability with those capable of intelligent analysis as top-grade students, the IC course shows clearly, through the constant contact in discussion sessions, which student correlates and synthesizes information and which one merely commits material to memory. As a direct result, one can selectively encourage concentration in biology or in the sciences in general.

The IC course permits maximum contact evaluation of effort, achievement, and learning on the part of the student. While the teacher in a standard course finds out three or four times a semester (at each examination) how much his students have learned, the IC instructor finds out three or four times a week (at each class meeting). In addition, there is considerably more personal contact outside the classroom, for students often visit the instructor's office to continue or complete the discussion of a particular point.

The IC course permits the student to develop an area of biological knowledge that possesses an intrinsic interest for him. He is given time to browse through the entire field, and select for thorough investigation a topic of personal appeal. This provides as many unique areas of information as there are students, and gives each a solid basis for independent contribution to discussion. It tends, at the same time, to maintain a high individual interest level. This is in contrast to the development of an area of knowledge that possesses an intrinsic interest only to the professor and is followed by the student primarily because he has no recourse. Since the field of biology is full of interesting areas of investigation, it is desirable to permit the student to find out about them. The IC course has been sufficiently successful in maintaining interest so that students have engaged in original research in connection with their papers and have included their own experimentation as part of the documentation.

The IC course provides the student with a chance to see why he is doing a particular piece of investigation or learning a specific fact. He accumulates his information as a consequence of having a question arise which he cannot answer, and therefore he sees a reason for accumulating it. Herein lies the virtue of a single book or a single theme, for information bearing on the theme must be sought by each individual and he can understand why he is seeking it.

The IC course has demonstrated that the important facts and concepts of biology need not be emphasized; on the contrary, the students work their way up to the theories in much the same fashion biologists did. It also demonstrates that students, given freedom of investigation, find themselves working on many of the things most biologists would like to see as part of freshman course content. For example, each of the following subjects came up and were discussed as a consequence of student questioning, over a three-week period: activation of the egg and embryonic control of differentiation; genetic control of metabolism; steady state maintenance; the community as a super-organism; mutation of genes, gene structure and gene action; hormones and their actions; and the physiology of hibernation.

But perhaps the most important consequence of the IC courses is the fact that it permits a student previously unfamiliar with the field of biology to find out how biologists work, think, and act. It gives him a chance to evaluate at firsthand the kind of future that biology can offer. It demonstrates the life and ferment within the field, and gives him something concrete on which to base a decision as to its promise as a career. The methods of biology as a science are familiar to him as a consequence of having worked with them, not as an abstraction which he has been told is important, so he must learn it. In short, I think it gives an outstanding opportunity to recruit new biologists.

## Problems in the Use of the Technique

One of the primary difficulties in this method of teaching is that it is more easily abused by the staff than is the standard lecture course. Unless the instructor is most patient, the witnessing of the slow pace at which learning is achieved independently can be infuriating. Unless the instructor is willing to let the student formulate opinions, be they good or bad, without expressing himself violently on the value of the opinion, the course will not be completely successful. If the instructor repossesses the mantle of responsibility that should, according to the basic concepts of the course, adorn the shoulder of the student, the course will fail. In short, the instructor's responsibilities are much greater than when his primary function is the organization and presentation of well-organized, informative lectures.

A second problem implicit in the IC course method is that of time. The maximum number of students that can be handled satisfactorily by any one instructor is about 80-100. This permits him to meet once a week for 2-2½ hours with small discussion groups of 20-25 students. If, in addition, one hour a week is devoted to a general meeting of all students assigned each instructor, during which examinations, short lectures, general class assignments, and so on can be taken care of, we have a total of nine contact hours a week. In addition, of course, there are the regular laboratory periods. In contrast, standard lecture courses with 80-100 students will normally meet three hours a week for lecture, plus laboratory sessions. In a biology department devoted solely to teaching, the IC program offers an opportunity to develop future biologists, but in a department which places as great an emphasis on research as on teaching, the time factor alone militates strongly against the IC method.

A third difficulty is that of staff. If a department currently assigns 350-400 freshmen to a single lecturer in general biology, it will of necessity find a considerable increase necessary to allow each staff member to deal with only 80 students. If, however, a staff is so composed that sufficient members of instructor rank or higher are available and each is assigned 100 or fewer students, the possibility of utilization of this approach to the instruction of biology could be seriously considered.

A fourth difficulty that is more fancied that real is that of future success of a student trained through this approach in advanced biology courses. To learn whether any handicap exists, we have examined the grades of all "IC" students in the next course in the departmental sequence with those of students who have not participated in the IC course in biology. This course is Comparative Anatomy, which is organized along more standard lines than the IC course. The results of this comparison are shown in Table 1, which is arranged to show the percentage of IC students falling within each letter grade. This should be compared with the percentage figure for total participation in the course by IC students. It will be seen that the IC students do not seem to have been handicapped in handling work in a difficult course as a consequence of participation in the IC course.

TABLE 1

| Grade | A | B | C | D | E | Totals |
|---|---|---|---|---|---|---|
| Total | 12 | 61 | 64 | 35 | 8 | 180 |
| IC | 5 | 17 | 12 | 5 | 0 | 39 |
| Other | 7 | 44 | 52 | 30 | 8 | 141 |
| % IC | 42 | 28 | 19 | 14 | 0 | 22 |

Performance of IC students in Comparative Anatomy, compared with all students who did not take IC courses. In each case the percentage of the total people with a specific grade who were IC students should be compared with the percentage of the total students in the course who were IC

students. For example, of the 61 students who earned a B in Comparative Anatomy, 17, or 28%, were IC students, although only 22% of the entire group was made up of IC students. The comparison is based on the Comparative Anatomy classes for 1955 and 1956, which are the only ones for which data is available.

### Conclusions

It has become apparent from experience gained in this course over four years that the average student is capable of handling material ordinarily thought to be well above his capacity. It will be obvious to many that this has been a freshman course conducted along the lines of the traditional graduate seminar. It should be pertinent to all biologists concerned with the training of future colleagues that freshmen are capable of whole-hearted response to this kind of treatment and that they will rise to an unanticipated level of achievement in such a course. It seems entirely possible that if our interested students were encouraged to move along at their own rate they might well make more rapid progress than they make under current pedogogical techniques, throughout their period of training.

There is little doubt in my mind that these techniques can be successfully applied as well in the courses offered to the undergraduate majoring in biology. While it may horrify some to think of students turned loose in the specialized fields to forage independently for their conceptual and factual fodder, it should be plain to all that independent feeding is more stimulating than being force fed.

### Acknowledgments

Many of the ideas and procedures outlined here were originally formulated by Dr. Herman Chase, of the Brown University Biology Department, and I am indebted to him for reading the manuscript and allowing me to incorporate his original views. Drs. Clifford Noll and Werner Heim have also participated in and actively contributed to the course.

# To the Young Scientist on the Occasion of His First National Meeting

**FRANK N. YOUNG and SEARS CROWELL,** *Biology Department, Indiana University*

*Dear Jim:*

We hear that you are not planning to attend the coming AIBS meetings, and further that you did not attend the AAAS meetings last year. This troubles us since it seems that as we grow older the people we see at national meetings grow older too. The same old and older faces keep showing up year after year while you young folk, if you are not boycotting us personally, are staying away in ever increasing numbers.

Everyone says that there is a pressing need for more scientists; we know that there is need for new blood at our national meetings. These are only diffierent aspects of a single problem. In your case, you obviously recognize the joys of science as a career, but have you been impressed with the opportunities you are missing? A man who is missing opportunities is not getting all the joy out of his career and is thus in no condition to inspire others to emulate him. You need some down-to-earth advice on how to compete with your elders in availing yourself of the multitudinous advantages of a national meeting, and as life-long students of the subject we are going to give it to you whether you want it or not.

Your remark that you don't think the expense of a trip to California will justify the return is particularly gratuitous. Just what return are you expecting? A great national meeting presents the opportunity of achieving all the recognizable goals of our culture—intellectual stimulation, self-expression, material gain, personal enjoyment, and escape. Since you obviously have an intellect to be stimulated, achievements to express, and could stand more material gain you should be able to bear the possibilities of pleasure and escape despite your New England conscience. You have simply listened uncritically to too many critics. In spite of the heroic efforts of officers and local committees, great meetings are necessarily complex organisms. If things do not proceed as you think they should it is probably your own fault. Life, after all, is a process of injecting one's own order into apparent chaos.

### Intellectual Stimulation

The first injection will come on your first evening of the meetings. After you have registered, you will find yourself in a mob of unfamiliar faces. Lost in this dross are the friends and colleagues from whom you may hope for intellectual stimulation. But there are important scientists, interesting people, and heads of departments. Your central problem is how to break into this continuum gracefully.

Here your personality must guide you. The extroverts simply wander about reading name tags. For this the far-sighted with long memories have a special advantage; some, for example, can read a tag at 50 feet and recall an item revelant to the wearer while advancing open-armed across a crowded lobby. The myopic, in contrast, slither through the crowd reading names at close range to right and left and then approach their unconscious prey from the rear.

A modest person, like yourself, may find this approach too crude; and, in fact, it is quite unnecessary. Just put yourself in some exposed spot and begin picking out the papers you want to hear from your program. This leads the extroverts to you as if by magic, and your next problem is to cope with their comradely good fellowship. In order to avoid too much intellectual stimulation and to achieve variety, you must at one instant "break the ice" and at another artfully disconnect the contact. A few simple expedients are indispensable here.

Starting a conversation with an older man, distinguished in his field, is particularly hard. One of our colleagues has confessed that he often opens a conversation by asking, "How is your book coming along?" Nine times out of ten, the individual has published a book, is working on one, or is contemplating beginning one since this is an occupational disease.

Discreet flattery is one of the surest ways to true intellectual stimulation. If handled properly you may even find yourself glowing in return. Never, however, under any circumstances compliment another worker in the same field as your protagonist. You cannot at your stage risk blundering into some feud that started while you were in diapers.

Sometimes it is imperative to leave one group and join another. Perhaps a friend is signalling from the door of a bar. A painless, socially acceptable way to break off is to ask someone to give your regards to one of his colleagues back home. Since these regards are practically never delivered, or else the deliveree forgets your name, it makes no difference whom you name. Just depart immediately so as not to invite questions as to details.

The worst situation in which one gets entangled is a conversation with a monomaniac. You feel that you must change the subject or perish. This is difficult to do since the transition must appear natural and some connective must be found. We, for example, often recall in the midst of prolonged discussions on the embryogeny of the nervous system that water beetles/hydroids have

nervous systems. The transition may not be as smooth as one would wish, but sometimes, thank heavens, it transits.

A better way of dealing with the monomaniac is to tell him that Professor Blank, over yonder by the potted palm, would be interested in his ideas. This is temporarily flattering to all concerned.

### Self-Expression

The formal sessions of the societies offer great opportunities for self-expression, but a few words of caution may be timely. Don't overdo this aspect of the meetings. Don't try to present a paper before every society of which you are a member, particularly if you are, like us, sucker for those pseudoengraved invitations beginning, "The executive committee of the Society for the Study of Nemathybomes has unanimously voted to elect you a member. . . ." If you attempt too much you may find yourself scheduled to be in two places at the same time or so near it that the timing is impossible. Inevitably you will make enemies by such a procedure because some of your friends are going to feel impelled to follow you about. It is a remarkable scientific fact, that in the eyes of the next speaker the tiny group that rises with you to go to your next paper is a stomping, madding mob leaving the chamber practically vacant.

Don't try to judge the success of your self-expression by the rush of reporters at its end. If you are rushed, you are apt to find yourself immortalized under some such banner as, "Snake Oil and Tree Snails Enliven Science Meet." If your paper is really deep, preferably proteinaceous, be concerned to answer the question, "What bearing does this have on the cancer problem?" Don't blame the reporters! As one confessed, "We're too busy watering down politics, watering down economics and watering down science to keep up with all the latest developments. You're supposed to know." So if you don't, find out!

Various adjuncts to self-expression should not be overlooked. The hallway symposium conducted in loud clear voices is marvelous if it appears unplanned. Neither of us, however, has ever been able to accumulate a large enough coterie to make it effective.

The dynamic presentation followed by an overt nap in the front row may also be used to demonstrate your breadth and consequent disdain for other work in your field. This is, of course, particularly effective if you are older and somewhat distinguished, but it pays to practice.

Too often, of course, in the rush of affairs we forget that deadline. There is still no cause for despair. Two hackneyed, but basically sound means of obtaining self-expression are immediately available:

(1) The Innocent Question: Since most papers are followed by a short discussion period, take advantage of it. Pick out some apparent flaw in a paper, related or unrelated to one you might have written, and prepare a question on the back of an old envelope. Now pay no further attention to the speaker, but crouch alertly ready to spring up the moment he stops. Since most of the time he will have answered your query in the latter part of his paper, you may appear stupid but people will remember you.

(2) The Intercalated Paper: Another gambit is to prepare a question you are sure the speaker will not be able to answer. When he hesitates, if only momentarily, produce the pocket-full of slides you just happen to have with you and discourse. Unless the chairman is alert and nasty you may be able to work in five minutes on your own research.

### Material Gain

The intersessions are the time for position seeking, sometimes crudely referred to as "job hunting". At such times the important heads of departments are in a relatively receptive mood. It is dangerous to try to mix business with pleasure in the evenings. In the latter situation it is too easy to give the wrong, albeit correct, impression.

In the long run, however, you will probably get a really good job only on the basis of your own merits so we can give you little advice.

### Personal Pleasure and Escape

As the paper reading sessions draw to their daily close, the crucial decision of what to do with the evening approaches. You must keep in mind that a careful balance must be struck between enjoying yourself and incapacitating yourself for later activities. Some of the older men apparently spend most of their days at meetings in bed, but this is not recommended for those on their way up as it were.

As you grow older the problem of your evenings will be solved, but go easy at first because bar bills can be startling. Your present question may be, should I attend the presidential address of the Society for Experimental Palaentology, or seek other cultural activities. Since your chances of seeing distinguished scientists in either of these activities is about equal, you must make your selection on the basis of other considerations: (1) The presidential address on "The Cretaceous Origins of the Judaeo-Christian Socio-Economic Basis of Society" is almost sure to be published, and you can read it later. Further, it is apt to be largely a complex embellishment of a few simple truths. On the other hand (2), the burlesque or a good floor show—the only cultural activities in which we have noticed young male scientists taking any interest—is not apt to be published, and will probably consist of a few complex facts simply disembellished and clearly revealed.

We do not wish to influence you unduly, but we must point out that the senior scientists have long recognized the value of cultural activities following a day of intensive concentration. Nothing epitomizes this recognition better than the remark of a friend as we passed the Fox Theater in Indianapolis during a meeting some years ago. "If," he said, "the roof of the building had collapsed last night, American biology would have been set back 50 years."

Yes, national meetings offer many opportunities. You should come home brimming with new ideas, of one sort or another, for there is nothing more stimulating than a great meeting where the great, near great, going-to-be-great, and grating scientists of the nation meet in a vast syncytium of psychic trophalaxis. Here, new ideas blossom, like exploding rockets, above our heads, and old ones burst out anew with various amplitudes of the dull thud. Idea men, promoters, job-hunters, simple scientists, amateurs, and pedants interact in an atmosphere of coruscating intellectualism. This is the epinephrin of science. There is no substitute.

See you at Palo Alto.

As ever,

FRANK AND SEARS.


***See you at Palo Alto?***
***Yes, indeed!***

# 8th ANNUAL MEETING OF BIOLOGICAL SCIENCES

**Stanford University**

August 25-29, 1957

***Register Early*** ***Register Early***

*Gibraltar Island, the site of the Franz Theodore Stone Laboratory of the Ohio State University at Put-in-Bay, Ohio.*

# The Franz Theodore Stone Laboratory

**CHARLES A. DAMBACH and LOREN S. PUTNAM**[1]

THE summer biological station of the Ohio State University at Put-in-Bay, Ohio is maintained on Gibraltar and South Bass islands in the archipelego of Western Lake Erie. Headquarters for the program are in the Franz Theodore Stone Laboratory on University-owned Gibraltar Island. Here the University conducts courses in the biological sciences and a research program designed to meet the needs of advanced undergraduate and graduate students from its biological science departments and of those from other institutions interested in the special opportunities this station provides. Summer field courses carrying advanced undergraduate and graduate credit are offered by the departments of Botany and Zoology-Entomology. Special emphasis is given to subjects related to the rich aquatic resources immediately at hand and the special environmental conditions characteristic of this island area. The teaching and research staff is made up of specialists in the Ohio State University and other institutions throughout the country.

An effort has been made to provide courses of instruction not ordinarily offered in campus situations with emphasis on locally available materials. Current courses offered include Field Botany, Higher Aquatic Plants, Advanced Entomology, Aquatic Entomology, Field Zoology, Ichthyology, Limnology, Ornithology, Invertebrate Zoology and Animal Parasitology. Courses are given during two five-and-one-half week terms of the University's Summer Quarter, which normally runs from mid-June to August 31. Eight quarter hours' credit may be earned each term or 16 hours for the entire summer.

The shallow waters of Lake Erie adjacent to the Laboratory support an abundant and varied fauna and flora which has attracted the attention of scientists for many years. This great productivity supports a food chain culminating in an extensive and economically important fresh water commercial and sport fishery which operates from nearby ports. The Laboratory is well equipped for field and laboratory studies both in the adjacent shallow and the deeper parts of the Lake. Available equipment for this purpose includes a research vessel, two vessels for student and staff transportation, smaller craft including rowboats and boats with outboard motors, standard aquatic collecting equipment such as dredges, quantitative plankton nets, bottom trawls, fishing nets, subsurface photographic apparatus, reversing thermometers, bathythermograph, high speed centrifuge, autoclave, spectrophotometer, water bath, drying and incubating ovens, optical and other equipment and supplies necessary to study aquatic organisms and their environment.

A wide variety of terrestrial habitats are available for study. These range from dense marshes adjacent to shallow ponds to dry, thinly-vegetated limstone cliffs. A wide variety of shore conditions exist. These include gradually sloping sand beaches, pebble and rubble-strewn beaches and precipitous cliffs. There are many reefs and shoals in the area and a number of unoccupied islands in various stages of plant succession. Unusual opportunity is afforded by these situations for ecological studies with insular populations. Opportunities for life history studies of birds, especially colonial nesting species and those characteristic of island regions, are excellent. There are a number of rookeries on nearby islands and a high resident population of song, insectivorous and game birds on the larger islands on which agriculture is practiced.

Trips are taken to the mainland by University launch to study special habitats.

[1] Dr. Dambach is Director of Ohio State University's Natural Resources Institute, which has administrative responsibility for the Franz Theodore Stone Laboratory. Dr. Putnam is Director of the summer teaching program at the Laboratory and is an Associate Professor in the Department of Zoology and Entomology at the University.

Among the areas available for study are an enormous open flowing spring of several acres' extent and considerable depth known locally as a blue hole, several hundred acres of undisturbed wet prairie in the Resthaven Wildlife Preserve at Castalia, public marshes aggregating several thousand acres in area and a variety of land use conditions characteristic of the lake plain of northern Ohio.

The University has maintained a biological station in this area without interruption since 1896. For a time, 1938-1955, it conducted a year-round program with major emphasis on hydrobiological research in the present headquarters on Gibraltar Island. The year-round program was discontinued in October, 1955 and new emphasis directed toward the summer teaching and research program. Responsibility for use of the facilities was placed in a newly-created Natural Resources Institute, and the teaching program was re-established in regular campus departments.

This is the second year of operation under the new plan. Dr. Loren S. Putnam of the Department of Zoology and Entomology is in charge of the summer teaching program. Persons interested in course work at the Laboratory should address inquiries to Dr. Putnam. Anyone interested in use of the facilities for research purposes should address his inquiry to the Director of the Natural Resources Institute, Charles A. Dambach, Ohio State University.

The research facilities are available during the summer period. By special arrangement they may be used at other times of the year. Office space and research facilities are available to qualified persons or agencies. A nominal fee may be assessed for use of these facilities. Living accommodations and dining facilities for students and research workers are available in University quarters at nominal rates. Although in the heart of Ohio's vacationland, the island location of the Laboratory assures quiet, pleasant surroundings with endless recreational activity near at hand for those desiring it.

# The Santa Barbara College Marine Biological Laboratory

**DEMOREST DAVENPORT and DONALD K. JOICE**

IN 1954, the University of California, Santa Barbara College moved to its new 400 acre campus directly on the sea, ten miles west of Santa Barbara at Goleta. At the time of the move the new Science Building was ready for occupancy. A group of temporary buildings on the beach, some 400 yards from the Science Building, had been converted and were ready for operation as a Marine Biological Laboratory.

The main building consists of a teaching laboratory with aquarium tables for twelve students, a small research laboratory adequate to house two workers, and an aquarium room. In an out-building there are storage spaces for preserved collections and equipment such as seines, dredges, plankton nets, etc. A twelve foot aluminum boat, outboard and trailer are available.

The design of the sea-water system for the laboratory is particularly interesting. The general mechanics of the intake and pumping system were dictated by the physical characteristics of the beach area adjacent to the laboratory and by a limited budget which prohibited the installation of a pier or other device to reach beyond the sand-ridden surf. A further requirement was ease of operation and maintenance.

The beach floor is made up of soft but impervious Monterey Shale. The depth of the shale strata is approximately 1,000 feet, with a surface sloping gradually out to sea for hundreds of feet. The sand deposits over the shale change dramatically with the seasons. At certain times of the year the shale is virtually clear, while at other periods the sands will drift to depths of ten feet. Under these conditions any sea-water intake had to be rugged enough to stand the tidal action, if exposed, and yet simple enough to be trouble-free when inaccessibly buried under a sandbar. Fig. 1 represents the basic design of the system. A concrete box equipped with perforated tubes was filled with a filter medium of graded sand and gravel. With the use of conventional construction equipment this box was sunk in the shale during an extreme minus tide as far out as possible and was connected to the pumping system on shore by piping, which was also buried in the shale. A centrifugal pump in circuit with a jet pump (Venturi unit) and two storage tanks complete the system. The centrifugal pump runs constantly, getting its water from a storage tank, pumping it through the jet pump and back into the tanks. As water passes through the jet pump, negative pressure is created in the intake line from the filter box. When there is sea water over the filter box, it is drawn into the system. The sea water reserve in the storage tanks keeps the laboratory operating and the centrifugal pumps circulating for the two or three hour period during occasional extreme low tides when the box is exposed. The only controls of the system consist of manual switches at the centrifugal pumps and a low-water cut-off float switch in the storage tanks. In the absence of stored salt water the system can be primed by the use of a small self-priming pump tied into the suction line near the jet pump. The system can also be entirely filled and back-flushed with fresh water.

Classes presented in the laboratory at the present time consist of an upper division course in invertebrate zoology during the regular session and a course in general marine biology during the summer session. Plans are afoot for the expansion of these presentations. Researches at present being conducted which are dependent on the laboratory are two Office of Naval Research contracts, one on the immunology of marine animals and one on the physiology of commensalism; a study on the protozoan parasites of marine fishes supported by the National Science Foundation; and two projects under University Grants, one on the population dynamics of barnacles and one on the embryology of surf perch.

The intertidal environment at Santa Barbara is largely sandy. A rich fauna may be collected on neighboring floats and pilings, while various points where there are large reefs and collections of boulders provide settlement for rock-inhabiting forms. An adequate representation of the major groups of the marine invertebrates may be maintained in the laboratory. The rich fauna of the exposed rocky outer coast is available at Point Concepcion and Morro Bay about two hours drive from the laboratory, while mud-inhabiting forms may be taken at the latter point. The laboratory is located directly on a lagoon with interesting possibilities for studies in osmoregulation, while the lagoon also provides a resting place for a rich fauna of migrant and resident water birds. The migration of the California Grey Whales passes directly by the laboratory in the spring.

Because of limitations in space the conduct of research in the marine laboratory itself is limited to those investigations

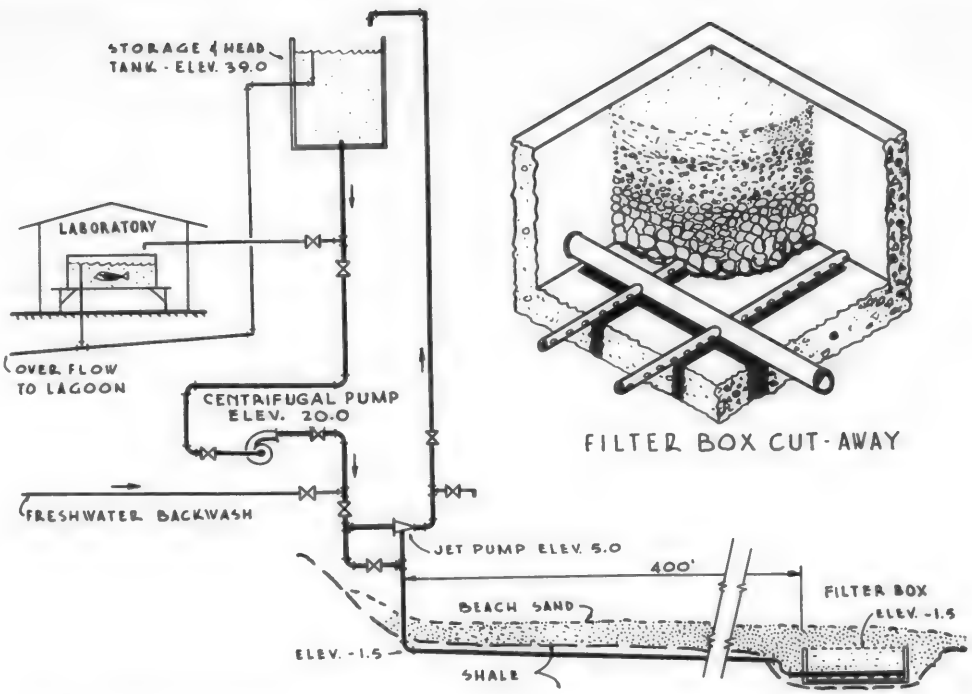


FIG. 1. *Diagram of sea water system. Marine Laboratory, University of California, Santa Barbara College.*

(behavior, etc.) demanding the immediate propinquity of running sea water. Adequate aquarium space is available for the storage of living animals, however, and facilities are available, particularly during the summer months, in the main Science Building for all sorts of investigations in which material from marine animals may be used. Hence, a limited number of visiting investigators can be provided for. Questions concerning the laboratory should be addressed to the Committee on Marine Biology, Department of Biological Sciences, University of California, Santa Barbara College, Goleta, California.

# The New Orleans Conference of Biological Editors

**H. BENTLEY GLASS**

*Johns Hopkins University, Baltimore, Maryland*

ON April 2-4, 1957, the first large-scale Conference of biological editors, organized by the AIBS, met in New Orleans for a 3-day consideration of common problems relating to the economy and management of scientific journals, the selection and preparation of material for publication, the cooperation of editors of journals with indexing and abstracting services, and the growing need for new media for the publication of scientific results. The Conference was the outgrowth of lengthy preparations, which began in 1955 with a preliminary planning conference of 12 editors and continued through 1956 and early 1957 with the program-planning and preparation of working papers under the direction of Dr. Fred R. Cagle of Tulane University, who served as Director and organizer of the Conference. The preliminary planning conference, the interim preparations, and the larger conference held at New Orleans were all generously supported by grants from the National Science Foundation.

The 46 editors of biological or partly biological journals who attended represented a carefully chosen sampling of various kinds of journals, since it was impossible to provide for the attendance of representatives of every biological journal in the United States. In addition, 13 observers were present to represent the National Science Foundation, the AIBS officers, staff, and Publications Committee, the Library of Congress, the Council of Library Resources, various biological societies or institutions which could not be represented by editors, and various firms

developing microforms of publication. Each participant in the Conference received, sufficiently in advance of the Conference for some serious study of its contents, a portfolio containing voluminous data relating to the problems to be discussed. There were, for example, the following: (a) an analysis of lists of biological serial publications, their nature, and rate of increase; (b) returns from a questionnaire sent to editors to elicit information on such matters as open and hidden costs, relative costs of independent and cooperative management, editorial labor involved, editorial procedures, subscription policies, stocking of back numbers and the like; (c) returns from a questionnaire sent to authors of biological papers to inquire regarding publication outlets, reaction to editorial policies and procedures, and personal scientific reading habits, circulation and use of reprints, etc.; (d) the report of the preliminary conference of biological editors and of other meetings related to the primary publication, exchange, and retrieval of scientific information; (e) a sample scientific newspaper in the form advocated by Dr. Ralph Cleland; (f) microcard and other microform samples, and literature about them; (g) literature on information retrieval systems and on research in that area; (h) a report from *Biological Abstracts* on the current status and scope of its operations; and (i) data relating to the need for and desirable character of a style manual for the guidance of biological editors and authors.

In addition to general sessions, the participants divided into five study groups which directed their attention respectively to the Economy and Management of Scientific Journals, the Use of New Media, the Selection of Material for Publication, Indexing and Abstracting, and the Permanent Organization of Biological Editors for Continuing Cooperation and Study of Mutual Problems. On each day of the Conference these groups made a progress report to the general session, and on the final day presented conclusions and recommendations which were submitted for conference action.

### Permanent Organization of Biological Editors for Continuing Cooperation and Study of Mutual Problems

This group made its final report first, recommending that a continuing organization of biological editors should be established. This recommendation having been approved by the Conference on April 3, the Study Group then drafted and submitted a Constitution and Bylaws, which were adopted in principle. A committee is to study the Constitution and Bylaws and recommended changes at the next annual meeting.

It was decided to call the new association, of which all editors attending the New Orleans Conference became charter members, a Conference rather than a Society, to indicate that in its future annual meetings and by means of its committees and study groups, it is to remain a real working body, devoting continuous attention to the common problems of biological editors and biological publications. All editors, past as well as current, are eligible for membership and are invited to join. Dues were fixed at $4.00 per year. The first slate of officers includes Bentley Glass, Chairman; Donald P. Costello, Vice-Chairman; and Fred R. Cagle, Executive Secretary. It was also unanimously voted to apply for membership as a Member Society in the AIBS.

### Economy and Management of Scientific Journals

From this study group came two recommendations that were adopted by the Conference. The great diversity of means of support among journals and the often hidden character of subsidies from institutions or societies was recognized. These factors make comparisons of costs problematic, if not impossible. It was therefore recommended that a committee should be set up to study the means of support of the various kinds of biological journals, to reconcile their cost accounting, and to report back to the Conference. Discussion of the preliminary studies carried out by the Director of the Conference made it quite apparent that the only reasonable uniform basis of comparing costs of publication is on the basis of cost per thousand words (or some multiple thereof). A second recommendation from this group recognized the existence of very great diversity also in the practice of obtaining support for the publication of manuscripts, through regular channels or extra, and asked for the appointment of a committee to study these practices and to recommend ways of reconciling them. This recommendation was also adopted.

### Use of New Media

The above study group spent considerable time analyzing the merits and the possible drawbacks of the experimental newspaper planned by Ralph Cleland as a substitute for publication of papers in full detail. The prepared sample specimen presented many features of interest, and everyone agreed that only the actual realization of this idea in printed form made it possible to consider the proposed medium critically. The final recommendation reached by the group and concurred on by the Conference was that: (a) the tremendous proliferation of scientific literature makes publication in some microform ultimately inevitable; (b) that sufficiently valid objections to the biological newspaper in the form presented to the Conference made it inadvisable to attempt publication at present; (c) that further exploration of new media and methods of publication should be carried out on an experimental basis by existing journals, either by giving authors permission to publish only a digest, along with the deposition and circulation upon request of the full paper in microform or photoprint, or else by experimenting with issues devoted wholly to author's digests of accepted papers, as before with the microform or photoprint circulation of the full paper. This latter experiment would serve to reduce heavy backlogs, and (d) that in any case of publication of papers in a digest form the fully edited, complete manuscript should be simultaneously issued in microfrom or photoprint and deposited in key foreign and domestic libraries. It was also recommended and adopted that groups of biologists planning to establish a new journal be urged to undertake instead a pilot project utilizing some form of new medium, such as macroform in brief coupled with micropublication in detail. The cooperation of professional librarians in any such undertaking was thought to be most advisable. Other recommendations from this group urged that special consideration be given to support for the publication of longer monographs in order not to discourage the preparation of such integrative studies; and that the lack of sufficient dissemination of scientific information at the senior high school and freshman college level suggests the need of a biological newspaper or magazine to serve this need, over and above the strengthening of existing services.

### Selection of Material for Publication

The group assigned to study the problems of the Selection of Material for Publication made five specific recommendations, all of which were adopted by the Conference. (1) A committee should be appointed by the Conference to draw up a general statement of editorial policy defining the editor's responsibility, on the one hand to his readers and his profession, and on the other hand to the individual authors who submit manuscripts for publication. This committee was specifically enjoined to consider the problem of whether to use anonymous or signed criticisms of manuscripts by referees. (2) The Conference is to appoint a second committee to consult with other scientific groups and draw up recommendations for a style manual for biological journals, to include "directions for standard forms of citations and abbreviations of journals titles, units of measurement, and other commonly used terms . . . typographical treatment of these, and other matters of common interest." It was universally agreed that common practice in these matters was badly needed. The consensus was that it does not much matter what standard forms are ultimately adopted so long as everyone uses them, and that editors agree to yield on their own preferences in order to achieve a common practice that can save enormous trouble for themselves as well as for authors. (3) The collective experience that graduate students need more training in scientific writing led to a resolution directing the Conference to address the Association of Graduate Schools and the Association of Land Grant Colleges, or other appropriate parties, in order to initiate concerted action to train graduate students in the biological sciences

to write for scientific publication. (4) Editors were specifically urged to include periodically in their journals instructions and advice calling the attention of their readers and potential contributors to the problems, uses, and misuses of scientific writing. (5) It was agreed that the services of referees are not to be considered part of the cost of publication of non-profit journals, and that no fees should be paid for such services.

### Indexing and Abstracting

The study group on the above subject also had concrete recommendations to offer, and all were adopted by the Conference. (1) All editors of biological journals are urged to assist the abstracting services in one of the following ways: (a) by requiring the author of each paper to submit with his original paper an abstract in place of a summary, the abstract to be edited by reviewers and editor, published with the primary article, and made available to the abstracting service for republication; (b) less desirable than the first method, but still helpful, is the distribution by the editor to his contributors of abstract forms, and the collection of these and their return to the abstracting service. (2) Editors are urged to ask authors to indicate the key works to be used in indexing their papers. This would be of assistance in the indexing services. (3) In the interest of international cooperation and standardization, editors and authors are urged to refer to the UNESCO "Guide for the Preparation and Publication of Synopses." (4) The Conference suggests to the abstracting services that they might increase their coverage by including more citations, especially of short papers. Editors should help by trying to have the titles of articles indicate, as precisely as possible, their contents. (5) The Conference commends the various abstracting services for the considerable steps already taken to cooperate with each other, and urges the extension of this cooperation as rapidly as possible. The time and effort saved by the use of a single abstract by several abstracting services can be employed to increase coverage of the literature. (6) The Conference encourages abstracting services to arrange their indexes in as standard a form as possible, and in such a way as to be amendable to automatic sorting. (7) The final proposal, a more complex one, concerns retrieval of biological information from the literature, a problem that faces all biologists engaged in teaching and research. Hunting for citations and abstracts consumes much time on the part of workers who could be more productively occupied, and the group found that this searching process could be mechanized at a cost inconsequential in comparison with the value of the time that would be saved. The Conference therefore requested AIBS to create a special committee to investigate and implement the development of automatic methods of retrieval of citations and abstracts.

These are only the major outcomes of a conference that all participants seem to have agreed was fruitful beyond any anticipation and beyond any similar type of conference within their personal knowledge. In a number of instances work on the proposals has already commenced. The area of agreement turned out to be broad, the differences minor. The modus of common action by editors was explored, specific recommendations were made, an atmosphere of accomplishment prevailed. There was also, of course, a universal recognition of the enormous problems facing editors and scientific periodicals in the future; but boldness together with a common-sense recognition of difficulties combined to encourage an attack upon them. The establishment of the Conference of Biological Editors as a continuing association ensures that the problems will not be left where they stand today, but that earnest thought and cooperative effort will be applied to their solution.


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# Across the Editor's Desk

• **The National Academy of Sciences, at its 94th Annual Meeting in Washington, D. C. in April, elected a vice-president, two members of the Council, thirty members and four foreign associates.** Officers of the Academy now are: President: Detlev W. Bronk; Vice-president: Farrington Daniels; Home Secretary: Hugh L. Dryden; Foreign Secretary: John H. Kirkwood; Treasurer: William J. Robbins. Harry L. Shapiro and Frederick Seitz were elected to membership in the Council. Additional members of the Council at the present time are: E. A. Doisy, Farrington Daniels, Theophilus S. Painter, I. I. Rabi, F. E. Terman, and Merle A. Tuve.

The following biologists were elected to membership: Edwin H. Colbert, American Museum of Natural History; Katherine Esau, University of California; Alexander Hollaender, Oak Ridge National Laboratory; Henrich Klüver, University of Chicago; Arthur Kornberg, Washington University Medical School; Joshua Lederberg, University of Wisconsin; Alden H. Miller, University of California; Roger R. D. Revelle, Scripps Institution of Oceanography.

**The Daniel Giraud Elliot Medal of the Academy for 1953 was awarded to Sven P. Ekman of Uppsala, Sweden.** The Elliot Medal has been awarded annually since 1917 for "meritorious work in zoology or paleontology published each year". Dr. Ekman's book, "Zoogeography of the Sea" was singled out for the award.

**The Academy's Kimber Genetics Medal for 1957 was awarded to A. H. Sturtevant,** Professor of Genetics at the California Institute of Technology. This Medal is given in recognition of great achievement in the science of genetics and was received previously by William E. Castle, H. J. Muller, and Sewall Wright.

**Award of the Public Welfare Medal of the Academy was made to James R. Killian, Jr.,** President of the Massachusetts Institute of Technology. This Medal, established in 1913, is the most distinguished of the Academy's awards. It is unique among them in being for the application of science in the public interest, whether by a scientist or not. Most of its holders are not Academy members.

• **The National Science Foundation announced 235 grants totaling $4,316,352 awarded during the quarter ending March 31, 1957,** for the support of basic research in the sciences, for conferences in support of science, for short term research by medical science students, for exchange of scientific information, and for training of science teachers. This is the third group of awards to be made during fiscal year 1957.

• **Research Corporation distributed $1,243,275 in 377 grants to aid basic research in science during 1956.** The grants were to 114 colleges and universities in the U. S., Canada, Hawaii, Cuba, West Germany and other countries. An article on the work of the Research Corporation appeared in the April 1957 issue of the *Bulletin*.

• **The U. S. Public Health Service recently announced approval of 35 grants totaling $3,974,943 to assist 27 research institutions in 18 states build additional facilities for research** in cancer, heart disease, mental illness and other major illnesses. The Congress, in 1956, authorized $30 million a year for three years in grants to research institutions on an equal matching basis for the construction and extension of research facilities. The law also established the Health Research Facilities Council, which has to date approved 109 grants totaling approximately $30 million.

• **The National Science Foundation released in April preliminary findings of a survey of expenditures for research and development in colleges and universities for the fiscal year 1954.** Approximately $285 million was spent, about 5 percent of the estimated total expenditure ($5.4 billion) by all sectors of the economy for research and development. The 38 largest schools accounted for nearly three-fourths of the total research cost. Of the Federal agencies, the Department of Defense supplied the bulk of support in the physical sciences, while almost half of the Federal support in the life sciences came from the Department of Health, Education and Welfare. The Atomic Energy Commission provided appreciable support in both fields. Requests for copies of the complete report should be addressed to: *Reviews of Data on Research and Development, No. 2, Funds for Research and Development in Colleges and Universities, 1953-54, National Science Foundation, Washington 25, D. C.*

• At the same time that the above report was released, **the National Science Foundation also issued one of a survey of expenditures for research in medical schools for 1953-54.** Of the 80 medical schools in existence that year, 74 were covered in this survey. They spent $66.3 million for research. Research faculty members (full-time equivalent) totaled 3,167. A breakdown of expenses by Federal and non-Federal support, clinical and non-clinical research, etc., may be obtained in the full report, *Review of Data on Research and Development, No. 3, Funds for Research in Medical Schools, 1953-54, National Science Foundation, Washington 25, D. C.*

• **The Board of Regents of the National Library of Medicine has announced the selection of a site for the proposed new Library building** on the grounds of the U. S. Public Health Service's National Institutes of Health in Bethesda, Md.

• **Yale University will begin construction this summer of a new two-story science building as a wing of the Peabody Museum, to house the Bingham Oceanographic Laboratory and the Ornithology Laboratory.** Estimated cost (43,000 sq. ft. floor space) will be around $650,000. It is scheduled for occupancy in January 1959. The entire first floor will house the Oceanographic Laboratory, with research quarters and offices. The second floor will be occupied by ornithological research laboratories, offices, a library and the William Robertson Coe Memorial Ornithology Room. The basement will provide 15,000 sq. ft. of dry storage space badly needed by the Peabody Museum.

• Omitted from the list of international congresses in the April *Bulletin* was the **4th International Congress of Crop Protection** to be held in Hamburg, Germany, September 8-15, 1957. Further information may be obtained by writing to: Biologischen Bundesanstalt für Land- und Forstwirtschaft, Braunschweig, Messeweg 11/12, Germany.

• **A course in Medical Mycology will be offered from July 1-27, 1957 at Duke University School of Medicine and Duke Hospital.** Instruction by members of the departments of medicine, pathology and bacteriology will emphasize the clinical, pathological and therapeutic aspects of fungus infections. Patients, clinical materials, cultures and laboratory animals will be available for study. An opportunity to study pathological materials, gross and microscopic, will be given those whose interest and previous training would make this of value to them. The practical laboratory aids which help to establish a definitive diagnosis will be stressed. The course is open to clinicians, pathologists, bacteriologists, technicians and others who have an interest in the medical phases of mycology. Classes will meet six days a week. Inquiries concerning this course should be directed to: Dr. Norman F. Conant, Duke Hospital, Durham, N. C.

• **The International Union of Biological Sciences is soliciting the assistance of all botanists to bring the *Census Botanicorum* up-to-date.** At the 8th International Congress of Botany in Paris in 1954, the names and addresses of 25,000 botanists and 5,000 establishments and societies in the field were obtained. In preparing for the 1959 Congress in Montreal, this list needs to be as complete as possible. The Secretary of the Botanical Section of I. U. B. S., Pierre Chouard, requests the Directors of Laboratories and Academies, supply him as soon as possible with information about Laboratories and personnel, and that society secretaries submit complete membership lists. Further inquiries

should be addressed to: Pierre Chouard, Prof. de Physiologie vegetale a la Sorbonne, 1, rue Victor-Cousin, Paris 5e, France.

• **The University of California Citrus Experiment Station, Riverside, California, as part of its 50th anniversary celebration, is planning a Conference on Citrus Virus Diseases, November 18-22, 1957.** The program will consist of two days for symposia and formal presentation of papers, one day of guided tours of the Station, and two days of tours to other citrus areas of California. Those who wish to attend or submit a manuscript for publication in the *Proceedings of the Conference* are requested to contact Dr. J. M. Wallace, Dept. of Plant Pathology, University of California, Riverside, California.

• **The 8th Annual Biological Symposium of the University of Michigan Summer Session will be held July 9-11, 1957.** The general subject is "Hormones and Growth". Speakers will be Dietrich Bodenstein, Army Chemical Center; Roy O. Greep, Harvard University; Frederick L. Hisaw, Harvard University; and Folke Skoog, University of Wisconsin. Housing may be secured by writing directly to: Michigan Union, 530 South State St., Ann Arbor, Michigan. Other inquiries should be directed to Dr. Burton L. Baker, Dept. of Anatomy, University of Michigan, Ann Arbor.

• **The Department of Botany, University of Washington, Seattle, will again conduct a Field Course in the Plants of the Northwest during the summer session, June 22-August 22, 1957.** As before, the Course will take the form of a mobile camping trip and this year will head for the mountain and plain country of Idaho, Montana, and the bordering provinces in Canada. Full University credit is offered. Total cost, including transportation, will be about $200. Detailed itinerary and other information may be obtained from: Dr. A. R. Kruckeberg, Dept. of Botany, University of Washington, Seattle 5, Washington.

• **Colorado State University (formerly Colorado A & M), Fort Collins, will sponsor the III Symposium of Reproduction and Infertility, July 1-3, 1957.** An outstanding group of speakers will discuss the latest research in: Diseases of Reproduction in Male and Female; Ovarian Physiology; Steroid Physiology and Therapy; Artificial Insemination; and Field Applications. The conference has been arranged to follow immediately the national meeting of the American Dairy Science Association, June 26-29 at Oklahoma A & M, Stillwater. Reservations may be made in college dormitories or in nearby hotels and motels. A registration fee of $5 will include a copy of the Proceedings of the Symposium. Detailed information and programs may be obtained from: Dr. F. X. Gassner, Colorado State University, Fort Collins, Colorado.

• **During the Annual Meeting of the Wildlife Society in March, 1957,** the Society's award for the best publication in the terrestrial wildlife field was received by **H. Albert Hochbaum,** Director, Delta Waterfowl Research Station, for his book "Travels and Traditions of Waterfowl". The award for the best publication in the aquatic (fisheries) field was received by **Louis A. Krumholz** for "Observations on the fish population of a lake contaminated by radioactive wastes", Bul. Amer. Mus. Nat. Hist. *110*(4): 281-367. Two Wildlife Awards were presented for outstanding work in the field of Conservation Education: (1) **Michael Hudoba** for his Report from Washington in *Sports Afield* Magazine and (2) **Harlan Brunsted** for the New York Sportsmen's Conservation Workshop, Cornell University.

• **Richard S. Cowan,** since 1948 a member of the herbarium staff at the New York Botanical Garden, assumed the duties of Associate Curator of the Botany Department at the Smithsonian Institution (Washington, D. C.), May 1. Dr. Cowan will continue his research on the Leguminosae of tropical America.

• **F. C. Steward,** Department of Botany, Cornell University, has been elected a Fellow of the Royal Society.

• In accordance with the policy of rotating department chairmanships at the University of Oklahoma, **Richard A. Goff** replaced **J. Teague Self** as Chairman of the Department of Zoology, June 1. Dr. Self as served as Chairman for the past 12 years, having been reappointed to serve two extra terms.

• **Albert Schatz,** Director of Research and Professor of Microbiology at the National Agricultural College, Doylestown, Pennsylvania, has been invited to present his work on the new proteolysis-chelation theory of dental caries at the Institute of Dental Surgery, London, England, June 12, and the 4th Congress of the European Organization for Research on Fluorine and Dental Caries Prophylasis at Malmo, Sweden, June 16, 1957.

• **C. Lalor Burdick,** secretary or Du Pont's Polyfibers Committee since 1946, has retired after 29 years with the company. As coordinating officer of this Committee, Dr. Burdick has helped direct the development of policy for all Du Pont activities in the field of man-made fibers. He has also been a member of the company's committee on fellowships and grants. Through his association with the Lalor Foundation (*AIBS Bulletin*, April 1956) which he has directed since its establishment in 1935, Dr. Burdick has been closely identified with the promotion of research and education in the biological sciences.

• **The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of research proposals in the life sciences is September 15, 1957.** Proposals received prior to that date will be reviewed at the Fall meetings of the Foundation's Advisory panels and disposition will be made approximately four months following the closing date. Proposals received after the September 15, 1957 closing date will be reviewed following the Winter closing date of January 15, 1958.

In addition to funds for the support of basic research in the life sciences, limited funds will be available during Fiscal Year 1958 (July 1, 1957-June 30, 1958) for the support of research facilities and programs at biological field stations.

Inquiries should be addressed to National Science Foundation, Washington 25, D. C.

• **Dean Amadon** has been appointed chairman of the Department of Birds, American Museum of Natural History, New York. Dr. Amadon will also remain Lamont curator of birds at the Museum. The ornithological collection at the American Museum is now one of the two largest in the world—containing more than 800,000 specimens.

• **Alan T. Waterman** has been renominated by President Eisenhower for a second 6-year term as director of the Nation Science Foundation.

• **Albert R. Mead,** professor of zoology, University of Arizona, has been appointed acting head of the department. He succeeds the late George T. Caldwell, department head from 1936 to 1956.

• **Hilary Koprowski,** who has been assistant director of viral and rickettsial research at the Research Division of the American Cyanamid Company, Lederle Laboratories, since 1946, became director of the Wistar Institute of Anatomy and Biology, Philadelphia, May 1. There Dr. Koprowski will head an accelerated program of research devoted to the study of single cells.

• **W. M. Bever** has been named head of the department of plant pathology at the University of Illinois, effective September 1. Since 1940 Dr. Bever has been with the U. S. D. A. at Urbana, working on cereal diseases.

• **J. Holtfreter,** professor of zoology at the University of Rochester, delivered the 1957 Jesup lectures in the Department of Zoology at Columbia University. Dr. Holfreter's subject was "Form and Action Development".

• **A new course on genetics and evolutionary theory will be offered during the 30th annual session of the Rocky**

**Mountain Biological Laboratory, Crested Butte, Colorado, July 1 to August 10.** It will be given by A. H. Sturtevant, California Institute of Technology, C. S. Pittendrigh, Princeton University, and Charles L. Remington, Yale University.

• **Herbert S. Gasser,** of the Rockefeller Institute of Medical Research, delivered the 1957 Hughlings Jackson Memorial Lecture at the Montreal Neurological Institute. He discussed "The Properties of Unmedulated Nerve Fibres with Afferent Function."

• **The International Society for Cell Biology has awarded the Ross G. Harrison prize to L. Siminovitch** of the Connaught Medical Research Laboratories, University of Toronto. The award consists of a travel grant of $750 for attendance at the forthcoming International Congress of Cell Biology.

• **George M. Darrow,** after 46 years of government service, retired in March from the U. S. Department of Agriculture. Founder of research on small fruits, Dr. Darrow is widely recognized for his work on new high-yielding strawberry varieties and in helping make possible the commercial production of blueberries in the United States.

• **Robert F. Smart,** chairman of the division of sciences and mathematics and professor of biology at Richmond College, has been appointed dean of the College.

• **Clifford Grobstein,** specialist in developmental physiology and tissue culture at the National Cancer Institute, Bethesda, Maryland, has been appointed professor of biology at Stanford University, California.

• **Bernard D. Davis,** professor of pharmacology and chairman of the department of pharmacology at New York University College of Medicine, has been appointed professor of bacteriology and immunology at Harvard University and head of the department of bacteriology and immunology in the Harvard Medical School, effective July 1, 1957.

• **The Department of Biophysics, University of Colorado Medical Center, Denver, is offering a three-day series of conferences and laboratory demonstrations dealing with quantitative methods of mammalian cell culture, September 9-11, 1957.** Application of these methods to problems of mammalian cell growth, genetics, nutrition, and interaction with agents like x-radiation and viruses will be considered. These sessions will be open to responsible scientists engaged in teaching and research. Applications will be accepted in order of their receipt, to the limit of available accommodations. Inquiries should be sent to: Office of Graduate and Postgraduate Education, University of Colorado Medical Center, Denver 20, Colorado.

• **The XVth International Horticultural Congress will be held in Nice, Cote d'Azur, France, April 11-18, 1958.** President of the Congress will be Henri Queille, President of the National Horticultural Society of France and former Premier of France. The Congress theme will be "Science in the Service of Horticultural Technics." Copies of the program may be obtained by writing to: Secretarial General, XV International Horticultural Congress, 84, Rue de Grenelle, Paris VII, France.

• **Harold Bold,** Professor of Botany, University of Tennessee, has joined the Department of Botany, University of Texas, effective September 1, 1957. Dr. Bold is Secretary of the Botanical Society of America.

• **H. Burr Steinbach,** professor of zoology at the University of Minnesota, has been appointed Chairman of the Department of Zoology at the University of Chicago, effective July 1, 1957.

• **The 75th Anniversary Symposium of the New York State Agricultural Experiment Station, Cornell University, will be held at Geneva, N. Y., October 4, 1957.** Subject of the Symposium is "The Role of Agriculture in Future Society", and among the topics to be discussed are: Atomic Energy and the Future of Agriculture, Radiation Preservation of Food and its Effect on Agriculture, Food Processing and the Future of Agriculture, The Development of Future Food Crops, Agriculture and the Industralization of Photosynthesis. An address will be given by Governor Averell Harriman.

**Recent deaths among biologists:**

**Arthur Weysse,** Wobrun, Mass.; professor emeritus of Boston University. 88; Sept. 1956.

**Carl E. F. Guterman,** Ithaca, N. Y.; director of research, State College of Agriculture and Home Economics, Cornell University. 53; March 1957.

**Joseph R. Slevin,** San Francisco, Calif.; curator, Dept. of Herpetology, California Academy of Sciences. 76; Feb. 1957.

**Richard S. Lull,** New Haven, Conn.; retired paleontologist at Yale University. 89; Apr. 1957.

**William G. Sawitz,** Philadelphia, Pa.; professor of parasitology, Jefferson Medical College. 63; Apr. 1957.

**Roland H. Patch,** Storrs, Conn.; retired professor of floriculture, University of Connecticut. 68; Apr. 1957.

**Adam G. Boving,** Washington, D. C.; associate of the Smithsonian Institution; former senior entomologist of the Bureau of Entomology and Plant Quarantine, U. S. D. A. 87; March 1957.

**Frederick B. Flinn,** New York, N. Y.; retired physiologist, industrial toxicologist, and associate professor of industrial hygiene, College of Physicians and Surgeons, Columbia University. 80; April 1957.

**Bruce D. Reynolds,** Charlottesville, Va.; chairman, Department of Biology, University of Virginia. 62; Apr. 1957.

## From the Societies

• **The 16th Annual Symposium of the Society for the Study of Development and Growth will be held at the University of Rhode Island, Kingston, R. I., June 19-21, 1957.** The Symposium topic will be "Developmental Cytology"—changes in nuclear and cytoplasmic constituents during development and differentiation. Speakers will be: J. R. Preer, C. Partanen, R. C. Hsu, G. Klein, W. Beermann, H. Stich, D. v. Wettstein, D. Fawcett, A. Lehninger, and S. Spiegelman.

• **Future meeting sites of the Society of American Bacteriologists are:** 1958: Chicago, April 27-May 1; 1959: St. Louis, May 10-15; 1960: Philadelphia, May 1-5; 1961: Chicago, April 23-28.

• **In 1956 the Society of American Bacteriologists appointed a committee consisting of C. E. ZoBell (Chairman), R. H. McBee and F. D. Sisler, to formulate a program for the Society's participation in the U. S. Antarctic Mission to the International Geophysical Year.** Since then, Dr. McBee has spent some time in the Antarctic and Dr. ZoBell has made arrangements in New Zealand for the transfer of materials to shore-based laboratories. As now planned the program will involve microbiological examination of ice cores, air, sea water, marine sediments, rocks, and other materials from the Antarctic regions. The committee will welcome suggestions on its program and invites the participation of interested microbiologists. Details of the program may be obtained by writing Dr. Claude E. ZoBell, Scripps Institution of Oceanography, La Jolla, California.

• **The South Carolina Academy of Science,** at its April meeting in Columbia, S. C., elected the following officers: President: H. W. Davis; President-elect: G. B. Wolcott; Vice-President: H. W. Freeman; Councilors: J. C. Aull, Jr., J. C. Loftin, C. S. Patterson. Margaret Hess continues in the office of Secretary-Treasurer.

• **The Southern Section of the American Society of Plant Physiologists,** meeting in Birmingham, Alabama, in February 1957, elected the following officers: Chairman: J. L. Liverman; Vice-chairman: A. W. Naylor; Secretary: H. J. Teas; Directors: W. C. Hall, D. E. Davis, J. B. Whitney, and D. R. Ergle. The 1958 meeting of the Section will be held in Little Rock, Arkansas.

• **Several back numbers of the *American Journal of Botany* are completely or almost out of stock.** Since the cost of reprinting these particular issues is almost prohibitive, the business manager of the Botanical Society of America is asking individual botanists and institutions to sell these numbers to the Society. Anyone willing to do so is asked to contact James E. Canright, Dept. of Botany, Indiana University, Bloomington, Ind. The following numbers are needed: Vol. 1 (1914); Vol. 2 (1915); Vol. 4 (1917); Vol. 5 (1918); Vol. 7 (1920), 1-4; Vol. 27 (1940), 1-5; Vol. 29 (1942), 1, 2, 4, 10; Vol. 30 (1943); Vol. 33 (1946) 2, 3, 4; Vol. 39 (1952) 1, 2; Vol. 40 (1953), 1, 2, 4, 6, 10; Vol. 41 (1954), 2; Vol. 42 (1955) 1, 2, 3, 4, 5; Vol. 43 (1956), 1.

• **The Southwestern Association of Naturalists** held its 4th Annual meeting at the University of Oklahoma, Norman, May 10-12, 1957. Two days were spent on field trips in West Central Oklahoma. The Association is a five year old organization whose object is to promote the field study of plants and animals, living and fossil, in the Southwestern United States and Mexico. The Association publishes a quarterly journal, *The Southwestern Naturalist*. Editor: Lloyd H. Shinners, Southern Methodist University, Dallas. R. W. Strandtmann, Dept. of Biology, Texas Technological College, Lubbock, Texas is Secretary-Treasurer.

• 1957-58 officers of the **American Society of Human Genetics** are: President: William C. Boyd; Past-president: Curt Stern; President-elect: Madge T. Macklin; Vice-president: Frederick Osborn; Treasurer: H. Warner Kloepfer; Secretary: Eldon J. Gardner, Utah State University, Logan, Utah.

• **The National Speleological Society** elected the following officers: President: Brother G. Nicholas; Vice-presidents: Thomas C. Barr, George F. Jackson, Oscar W. Hawksley, and Dorothy Reville; Secretary: Frances Cross, 125 Tapawingo Rd., S.W., Vienna, Va.

• Officers of the **Animal Care Panel** for 1957-58 are: President: Jules Cass; 1st Vice-president: Bennett J. Cohen; 2nd Vice-president: Victor Schwentker; Secretary-treasurer: Robert J. Flynn, Argonne National Laboratories, Chicago.

• **The Wildlife Society** elected the following officers: President: A. Starker Leopold; Vice-president: Richard B. Miller; Past-president: D. L. Allen; Executive Secretary: Daniel L. Leedy, U. S. Fish and Wildlife Service, Washington, D. C.

• **The International Association for Dental Research,** a new Affiliate Society of AIBS, elected the following officers at a spring meeting: President: Reidar F. Sognnaes; Past-president: Joseph F. Volker; President-elect: Ned B. Williams; Vice-president: Hamilton B. G. Robinson; Secretary-treasurer: Dan Y. Burrell, University of Kentucky, Lexington, Ky.

• **The National Science Teachers Association** elected the following officers: President: Glenn O. Blough; President-elect: Herbert A. Smith; Secretary: H. M. Louderback; Treasurer: R. T. Lagemann; Executive Secretary: Robert H. Carleton, 1201 16th St., N.W., Washington, D. C.

• **The American Nature Study Society** will be served by the following officers during 1957-58: President: Richard Weaver; Vice-president: H. Seymour Fowler; Treasurer: Howard Weaver; Secretary: Helen B. Ross, State Teachers College, Fitchburg, Mass.

• **The Western Society of Naturalists'** officers are: President: William M. Hiesey; Vice-president: Tracy I. Storer; Treasurer: Marion Ownbey; Secretary: John P. Harville, San Jose State College.

# Education and Manpower

• **Grants totaling $138,000 have been awarded by the National Science Foundation to 18 colleges and universities to support in-service institutes designed to improve the training of high-school teachers of science and mathematics.** These Institutes will begin in the fall of 1957 and run through the academic year 1957-58, and will be held in the evenings and on weekends in order that teachers may attend them outside regular teaching hours. Travel expenses, tuition, and fees for each participant will be covered by the grant. Participants will be selected from high schools within a radius of some 50 miles of the host institution. The list of colleges and universities where in-service institutes will be held follows. All inquiries concerning admission should be sent to the director of the particular institute.

*Adelphi College*, Garden City, New York (Chemistry, Physics), Dr. Alfred M. Vogel, Chairman, Chemistry Department; *Antioch College*, Yellow Springs, Ohio (Biology, Chemistry, Mathematics, Physics), Dr. James F. Corwin, Department of Chemistry; *Ball State Teachers College*, Muncie, Indiana (Mathematics), Dr. Charles Brumfiel, Department of Mathematics; *Bowdoin College*, Brunswick, Maine (Physics), Dr. Noel C. Little, Chairman, Department of Physics; *Brown University*, Providence 12, R. I. (Biology, Chemistry, Mathematics, Physics), Dean R. B. Lindsay, Graduate School; *Carleton College*, Northfield, Minnesota (Geology, Astronomy), Dean Frank R. Kille; *Emory University*, Emory University, Georgia (Biology, Chemistry, Mathematics, Physics), Professor Floyd Jordan; *Fisk University*, Nashville 8, Tennessee (Chemistry), Professor Samuel P. Massie, Department of Chemistry; *Hampton Institute*, Hampton, Virginia (Chemistry, Mathematics), Dr. Frederick D. Inge, Chairman, Department of Natural Science; *Mount Mercy College*, Fifth Avenue, Pittsburgh 13, Pa. (Chemistry), Professor Cornelius Kreke, Chairman, Department of Chemistry; *Mundelein College*, 6363 Sheridan Road, Chicago 40, Illinois (Biology), Sister Mary Cecilia, B.V.M., Chairman, Department of Biology; *New York University*, New York 3, New York (Earth Sciences), Dr. Leslie E. Spock, Department of Geology, Washington Square College of Arts and Science; *New York University*, New York 3, New York (Mathematics), Professor Frederick W. John, Chairman, Department of Mathematics, Washington Square College; *Reed College*, Portland 2, Oregon (Chemistry, Mathematics, Physics), Dr. Arthur F. Scott, Department of Chemistry; *South Dakota School of Mines & Technology*, Rapid City, South Dakota (Chemistry), Dr. Don R. Macken, Director, Extension Activities; *University of Denver*, Denver, Colorado (Biology, Chemistry, Nuclear Science), Dr. Earl A. Engle, Division of Science; *University of Puerto Rico* (Mathematics), Professor Mariano Garcia, Department of Mathematics, College of A. & M. Arts; *University of Tennessee*, Knoxville, Tennessee (Mathematics, Physics), Professor W. W. Wyatt, College of Education.

• **Thirty-three high school science students from 14 states have been chosen as finalists in the 14th annual nationwide Bausch and Lomb Science Scholarship competition at the University of Rochester.** The finalist group, largest in the history of the competition, was selected from a record number of 800 applicants. Bausch and Lomb appropriates $9,600 annually for the scholarship program under which a minimum of three of the scholarships will be awarded. The amount of each award is based on the financial needs of the recipient. To be eligible to apply for the Rochester scholarships, students must have won a B. & L. honorary science medal, awarded annually in each of 6,000 participating schools to the senior who has the best record in science studies. In the 13 years that the competitions have been held, a total of 54 Bausch and Lomb Science Scholarships have been awarded. In addition, the University of Rochester has awarded others of its scholarships to 74 finalists who stood high in the final judging.

• **A new method of producing sound films for educational purposes has been successfully tested by UNESCO in the Middle East.** The method was put into practice by Norman F. Spurr, a British film producer, who recently completed a 9 month UNESCO mission in Jordan. In

the past sound films have had to be developed and processed in special laboratories, often located thousands of miles from the place where the film was produced and was intended to be used. Now, by adapting a technique used originally by amateurs, and increasingly by professionals working with 16 mm. film, the usual photographic sound track is replaced with a strip of magnetic material upon which sound is recorded directly. For 16 mm. film, the magnetic strip has many advantages; it gives better sound quality than photographic sound tracks; unsatisfactory recordings can be erased and new recordings made without the consumption of further materials; and a commentary in one language can be replaced by a commentary in another tongue. On one occasion, Mr. Spurr and one assistant produced an eight minute newsreel in four working days whereas formerly it would have taken a month or more. It is hoped that this method will bring about the production of cheap sound films for educational purposes for the places where they are most needed.

• **The Committee on Educational Interchange Policy** (1 East 67th St., New York 21) **has published a booklet on "Hungarian Refugee Students and United States Colleges and Universities".** It described the emergency program under which some 800 Hungarian students were placed in American colleges and universities from October 1956 to February 1957. The details of this program in modern educational history are carefully but briefly outlined. Copies are available through the Publications Division of the Institute of International Education (address above).

• **James B. Conant,** recently Ambassador to the Republic of Germany, and former president of Harvard University, plans to undertake a study of some of the problems of the comprehensive high school in the United States. The Carnegie Corporation of New York will support the research. Dr. Conant, with the assistance of several co-workers, will begin work in the fall of 1957. Particular interest will be paid the education of the more talented youth of the community.

• ***Encouraging Scientific Talent*, by Charles C. Cole, Jr., was published recently by the College Entrance Examination Board, Princeton, N. J.** It is the product of a careful survey and research project which combined a critical review of all existing literature in this field with a nationwide study of high school students and their plans. The book should be of interest of anyone concerned with increasing the nation's scientific strength and the identification and encouragement of capable young people.

• **John R. Mayor** has been appointed to the newly established AAAS position of the Director of Education. Since September 1955, Dr. Mayor has served as director of the Science Teaching Improvement Program that is financed by a grant from the Carnegie Corporation of New York. The new appointment reflects a decision by the Board of Directors of AAAS that active effort to improve the teaching of science and mathematics should constitute a major and continuing part of the Association's program.

• **The Office of Education has issued figures on degrees earned in institutions of higher learning in academic year 1955-56.** For the first time since 1950 they show marked increases in nearly every field of science and engineering at the Bachelor's level, but only minor changes in the number of recipients of higher degrees. The increase at the Bachelor's level amounted to 12%, and half of it was in the field of biology which, until this year, suffered a slow but steady decline. No explanation is available for the sharp drop in the number of doctorates awarded in agriculture and psychology, but the general decline at this level reflects the heavy draft calls made upon gradaute students in 1953 and 1954.

**Earned Degrees, 1954-55 and 1955-56**

| | Bachelor | | Master | | Doctor | |
|---|---|---|---|---|---|---|
| | *1954-55* | *1955-56* | *1954-55* | *1955-56* | *1954-55* | *1955-56* |
| All Fields | 287,401 | 311,298 | 58,204 | 59,370 | 8,840 | 8,815 |
| Agriculture | 7,170 | 7,286 | 1,364 | 1,467 | 507 | 398 |
| Biology | 9,050 | 12,566 | 1,609 | 1,759 | 994 | 1,022 |
| Mathematics | 4,034 | 4,660 | 761 | 892 | 250 | 224 |
| Physical Sciences | 10,516 | 11,672 | 2,544 | 2,640 | 1,713 | 1,635 |
| Psychology | 5,532 | 5,665 | 1,293 | 969 | 688 | 632 |
| (Subtotals) | 36,302 | 41,849 | 7,571 | 7,727 | 4,152 | 3,911 |
| Engineering | 22,589 | 26,312 | 4,484 | 4,724 | 599 | 610 |
| Totals | 58,891 | 66,016 | 12,055 | 12,451 | 4,751 | 4,521 |

## Know Your Associates

**Ward's Natural Science Establishment, Inc.,** of Rochester, New York, is as modern a scientific supply house as you will find anywhere, in spite of its quaintly archaic nineteenth-century name. The Victorian name merely reflects the fact that the Company has been doing business continually for nearly 100 years, and having become famous under the original name, nobody wants to change it. But that's the only thing at Ward's that hasn't changed with time.

As it now operates, Ward's is a supplier, to high schools and colleges, of teaching aids and specimens for the biological and geological sciences. Preserved dissection specimens, mounted skeletons, and many other useful items are handled by this versatile company. In all these matters, up-to-the-minute interests are emphasized, reflecting current trends in the teaching of biology and geology. Ward's has pioneered and developed the techniques of plastic-embedded specimens, latex injections of dissection specimens, and many other such features. These proved to be so useful that they were instantly taken up as standard techniques by other supply houses and by teachers. Ward's mounted skeletons have been noted for quality for many years, as Ward's deliberately holds back quantity production in order to produce fine quality work. In preserved dogfish, Ward's operates its own combined fishing and preparation station in Maine, so that dogfish are brought from the sea alive into the laboratory, an arrangement unique among biological suppliers.

At one time Ward's was strongly associated with a sort of "Old Curiosity Shop" atmosphere, and many of the older generation of scientists remember it as a place that would cheerfully lose thousands of dollars obtaining the left hind foot of a Malayan tapir for a customer, if that is what he wanted. But beginning in the nineteen-thirties, the present management has followed a policy of making Ward's useful to the national community of educators. Its present philosophy and work is far different from the "Natural History Cabinets" of grandfather's day. However, legend dies hard and people still come to Rochester looking for "Ward's Museum", believing that they will find wooly rhinoceroses and other such marvels.

Another legend, probably engendered by the name "Establishment", is that Ward's is some sort of endowed non-profit foundation. This is not true. Ward's is a privately-owned business enterprise, depending entirely on its sales for its support, the same as any other business.

Ward's is an interesting example of an old firm that has continued to progress with the times, remaining young and modern in its outlook and the materials offered to its customers. Ward's is staffed mostly by young men and women who see in the company an opportunity both to serve science and education and to establish for themselves interesting and satisfying careers.

# Annual Meeting of Biological Sciences

**Stanford University, California** **August 25-29, 1957**

Societies meeting under the joint auspices of the American Institute of Biological Sciences and the Pacific Division of the American Association for the Advancement of Science.

American Bryological Society
American Chemical Society (California Section)
American Fern Society
American Microscopical Society
American Phytopathological Society
American Society for Horticultural Science
American Society of Human Genetics
American Society of Ichthyologists and Herpetologists (Western Division)
American Society of Limnology and Oceanography
American Society of Naturalists
American Society of Plant Physiologists
American Society of Plant Taxonomists
American Society of Zoologists
Association of Pacific Coast Geographers
Biometric Society (WNAR)
Botanical Society of America
Ecological Society of America
Genetics Society of America
Herpetologists' League
Joint Committee on Grassland Farming
Mycological Society of America
National Association of Biology Teachers
Nature Conservancy
Phycological Society of America
Sigma Delta Epsilon
Society of American Bacteriologists (Northern California and Hawaiian Branch)
Society for Experimental Biology and Medicine (Pacific Coast Section)
Society of General Physiologists
Society for Industrial Microbiology
Society of Protozoologists
Society for the Study of Evolution
Society of Systematic Zoology (Pacific Section)
Tomato Genetics Cooperative
Western Society of Naturalists
Western Society of Soil Science

# A.I.B.S. MEETING OF BIOLOGICAL SOCIETIES

## STANFORD UNIVERSITY

**Stanford, Calif.**

## August 25-29, 1957

## INFORMATION ON HOUSING AND MEALS

**DORMITORY ACCOMMODATIONS:** University dormitories will be used to the limit that facilities are available, for the housing and feeding of single delegates, couples and families. If you are bringing infants and/or small children, please provide your own rubber sheets and other necessary equipment. All reservations for housing will include meals, on a package plan.

**OTHER ACCOMMODATIONS:** A limited number of accommodations will be available in the motels and hotels within a twenty-mile radius of Palo Alto. However, reservations for these accommodations cannot be handled by Stanford University officials, but must be made by the individual, directly with the motel of his choice. A list of available motels and hotels, with addresses will be found on p. 34. It should be emphasized that those individuals who do not choose to reside in campus dormitories cannot be fed on the campus but will be expected to eat at local restaurants.

**DORMITORY ROOMS MAY BE OCCUPIED:** For those attending the regular meetings, only, from noon on Sunday, August 25, until noon on Thursday, August 29. By pre-arrangement, pre-meeting groups may come in after noon on Tuesday, August 20. The expected date and time of arrival should be carefully indicated on the form below. Pre-registration is absolutely essential to proper assignment of facilities.

**RESERVATIONS:** May be made from now until August 20. Payment is to be made at the time of registration on the Stanford Campus.

**RATES:** Board and room in a University residence are on a "package plan" basis. The package plan covers the period beginning with housing Sunday, August 25, and dinner that evening, through housing Wednesday night, the 28th, and luncheon on Thursday noon, the 29th.

**ROOM:** $2.00 per night per person, including children. (Generally two persons assigned to a room.)

**BOARD:** $4.16 per day, per person (including taxes). The "package plan" includes all meals for the period of attendance for the regular meeting, with the exception of those special society banquets for which advance reservation has been made (and for which credit will be given in the cost of board). The AIBS members will take their meals in the dining room of the hall where they are living. Residents of halls having no food service will be assigned to other dining halls. Since Stanford is a residence University, the public eating facilities at this time are limited to snack bar and soda fountain service. Members attending the meetings but staying in the vicinity of the campus should not plan to eat on the campus during the conference program because of the limited facilities. Pre-conference arrivals may obtain a-la-carte food service prior to the beginning of the conference "package plan", if they have pre-registered.

**ACKNOWLEDGEMENT:** Each advance registration received before August 9, will be acknowledged by a form which should be presented at the registration desk at the time registration is completed. Registration will be in the Lobby and Lounge of Encina Hall.

**TO FACILITATE ASSIGNMENT OF ROOMS:** Those wishing to room together are to indicate this on the housing application form, or on an attached card.

**PRE-REGISTRATION IS ESSENTIAL TO PROPER ASSIGNMENT OF FACILITIES: Do it now and avoid disappointment later!**

### REGISTRATION AND HOUSING APPLICATION—STANFORD UNIVERSITY MEETINGS

Mail to: **Dr. J. M. Yarborough, A.I.B.S., 101 Encina Hall, Stanford University, Stanford, California**

Name..... (First) (Middle) (Surname)

Home Address..... (Street)

..... (City) (State)

Full names, Sex, Relationship of Members, Ages of children in my party

.....

.....

.....

.....

Professional Address.....

.....

Title.....

Institution.....

Society Membership

(1).....

(2).....

(3).....

I plan to attend the following society banquets

.....

If planning to attend a field trip, please specify the trip and the number in your party

.....

Male ☐ Female ☐

Expected time of Arrival*

at Stanford..... (Date) (Hour)

By train at Palo Alto ☐

By plane at San Francisco Airport (limousine service available to Stanford) ☐

By car ☐

Departure:

from Stanford..... (Date) (Hour)

Please make reservations for me in a University dormitory ☐

If lower floor accommodations are required for reasons of health, please specify under Remarks.

I will not require University housing ☐

Remarks:.....

.....

.....

* Due to the complexity of the Stanford University campus, every effort should be made to arrive before midnight.

Date.....

# Letters to the Editor

May 24, 1957.

With the heavy admixture of technological fields of training to the biological sciences, the meaning of the Ph.D. is becoming obscured. The goals of this graduate program are too abstract to permit of precise definition; however, a basis for use in establishing standards for the Ph.D. in biology and the applied biological sciences of agriculture may be as follows:

The Ph.D. program is designed to train people into a state of competence and flair in research and—more important—in creative thought. This basic design should stand undiluted by technological requirements which may be demanded of the man in his elected profession after completion of graduate work. The Ph.D. cannot be designed to prepare a man for a trade. The awarding of the degree is to signify that achievement has been won in (a) the basic concepts of his science, (b) in the techniques utilized in his and closely related sciences, and (c) in the assimilation of the literature—the specific information in the scientific area.

It is possible to recognize the arrival of the student to this state of development by the use fo two criteria. First, he must have attained confidence and originality in research. And second, he must have applied these attributes to the end of developing a set of original ideas on an experimental basis. This will involve a detailed familiarity with the literature in the area, and the scholarly proof of a new array of facts concerning these ideas. The achievement of this state of ripeness for the Ph.D. cannot be recognized much in advance or predicted as to its arrival time: it is normally reflected in the successful completion of a set of publications for a research journal.

Finally, the product of the Ph.D. program should be a man with a mind educated in the pathways of research. While he may have obtained technological training enroute to the Ph.D. which may be useful in his profession, this aspect should be entirely apart from the Ph.D. standards. Any deflection of these goals in order to better adapt a man to wage-earning potentials cannot help but add to a deflation of the value and meaning of the degree. The man who has achieved the aims of a research Ph.D. and has arrived at the state of familiarity with research described, will then be capable of developing a more provocative and meaningful career in the fields outside of research where the Ph.D. is required such as teaching, administration or technology. If the degree is oriented toward such applied training instead of toward research education it will rapidly be emasculated into a simple vocational apprenticeship.

Wordy attempts to describe such complex subjects as this have a hollow quality in common with dissetations on the meaning of other intricate qualities such as tolerance, objectivity and science; and this attempt falls into the same trap of the personalized meaning of words. Yet if we think actively about the goals of our graduate program, the very process of doing so cannot help but be beneficial to the program.

A. S. Leopold,
*Professor of Physiology*
*of Horticultural Crops*
*Purdue University, Lafayette, Indiana*

April 2, 1957

It has been called to my attention that a quotation credited to Rudyard Kipling in my article "Trends in Microbiology", *AIBS Bulletin* (Vol. VI, No. 5, Nov. '56) does not agree with many published versions of the poem. A number of sources state "five serving men" instead of the six I named.

Research by Mr. Clarence McK. Lewis of New York City has disclosed that Kipling's original version did in fact mention six serving men; however, I did misquote by changing the order of their duties. I trust no great harm has been done to Kipling—my deepest apologies.

For any who are interested in accuracy, Kipling's original is given below, following which my version is repeated:

I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who.

* * *

I have six faithful serving men.
They serve me till I die.
Their names are who and what, and when
and how and where and why.

Roger D. Reid
Biological Sciences Division
Office of Naval Research
Washington, D. C.

April 15, 1957

There is a strange new set of economic forces operating in our society which has not yet been identified, much less carefully analyzed. One of the symptoms of this is the firm belief in the "guaranteed job" which most people under thirty as well as many people over thirty years of age believe they have or can have. This belief is usually expressed negatively — "The government won't let a depression with wide scale unemployment occur because to do so would lead to Socialism". I think the net effect of these attitudes is playing a major role in the growing difficulty of recruiting enough good teachers to man our high school science departments.

As Mr. Gallup has taught us—it doesn't so much matter what the facts are—in a political democracy, it's often what the public *thinks* the facts are that really counts. So, for the first time in history we have large numbers of people living and working and operating in a society where the threat of unemployment no longer serves as an effective motivational incentive.

Winston Churchill one discussed the means of motivating donkeys. He pointed out, that there are two forces which can be used to stimulate donkeys, "sticks" and "carrots". If I may adapt this analogy to the human situation I am discussing, the threat of unemployment has long been the "stick" (sometimes hidden) that has helped to increase the appeal of some of the less tender "carrots", such as teaching. Since our society is now operating largely through the manipulation of "carrots", many new attitudes are taking shape. I believe, I can show that this changed motivational climate accounts in no small part for the scientific manpower crisis that is troubling us so much today.

In the pre-war "sticks" and "carrots" period, teaching possessed one major advantage over an industrial job—it was safe and sure and more or less "depression proof". True the prospects for advancement were somewhat limited, but in a society containing both "sticks" and "carrots" there was much to be said for a haven which was reasonably safe from "sticks" even though the "carrots" might not be so big and as sweet as in other less secure pastures. But, in a country where the "sticks" of unemployment has not been seen for nearly twenty years all those who are less than 30 years of age scarcely believe it ever existed. To them and even to a good many of those older than 30 the "stick" is absent from their planning. They are generally concerned primarily with locating the pastures where the biggest, sweetest economical carrots are to be found.

If we consider the attitudes of young college graduates as reflected by a student of Lehigh's (1955) seniors we see this "carrot" psychology at work. Here are the factors which these seniors considered most important in choosing a job.

1. Interesting work
2. Good training programs
3. Opportunities for advancement
4. Salaries equal to others in field
5. Retirement security
6. Location for good living conditions

Not a word to suggest that they thought anything of job security—just "Where is the best pasture?" Job security is assumed.

Now, I do not argue that we should restore the "stick". We couldn't do it if we wanted to. But when I compare teaching with science application and with business administration on this "carrot" scale of values, I am impressed that it will be impossible ever again to make high school teaching by itself sufficiently inviting to attract enough young people to solve our science teaching problem. There is just too big a differential in almost every one of these factors in favor of the job as an applied scientist or business administrator working for industry or government. Therefore, the only approach that is feasible is for universities, research institutes, indus-

try and government to assume *full* responsibility for staffing our high school science classes. Let them hire *all* young science graduates and then "farm" them out to the schools to teach for a part of their career. The local schools would reimburse the companies and/or government agencies for this service on some contractual basis.

Under this arrangement the schools would get a better grade of science teachers than they can now attract and the young scientists would get the experience of teaching which has long been known to be a most beneficial education experience for the developing young scholar—an experience which generally deepens the teacher's knowledge of humanity as well as of subject matter. Higher education, research institutes, industry and government would have a good "seasoning" plant where their young people would mature, and I believe the net effect would be to end the shortage of science students.

High school students would be learning science from those who believed in it enough to choose it as a career. Such teachers would surely be more enthusiastic "salesmen" for science than the usually underpaid, often poorly prepared and sometimes unwilling science teachers who are staffing many of the high school science departments at present. Thus science would probably achieve improved status in its competition with business administration for the best young minds. Science does have certain non-monetary "carrots" to offer which business lacks. These can only be described to young people by scientists who have experienced them.

This suggestion is made in recognition of the fact that if we do not soon begin to lower the deficit of science teachers and increase the output of young scientists, we shall in a very few years begin to face a situation where we are so low on "seed" that we cannot plant a full crop in some succeeding generation. It may be we have already reached this point. In any case the suggestion offered here is one which can be tested. If successful, it can be rapidly implemented at the local level, without too much control control or assistance.

JOSEPH W. STILL, M.D.
Washington, D. C.

# A.I.B.S. Reports

• **The AIBS Advisory Committee on Hydrobiology to the Office of Naval Research** held a meeting during the Inter-Island Marine Biological Conference, sponsored by the University of Puerto Rico, April 1-6, 1957 at La Parguera, P. R. This Committee made the following recommendations, which should be of interest to many *Bulletin* readers.

"1. AIBS should be encouraged to revise and extend the *Directory of Hydrobiological Laboratories and Personnel in North America* so as to include the Caribbean area, Central America and South America, and to list the names, addresses and the executive officers, in so far as is possible, for hydrobiological laboratories in the remainder of the world. A special committee should be established to advise on details of organization and the form of the Directory.

2. AIBS should send a brief resume of the pertinent recommendations emanating from this meeting to appropriate journals which include news and notes items so that the recommendations made will receive distribution.

3. If financially possible, hydrobiological laboratories should distribute collected reprints of their research papers annually to other hydrobiological laboratories which request them. The collected reprints should be securely bound for ease in handling and filing.

4. AIBS should investigate the feasibility of establishing a microform production center to distribute at minimal cost to hydrobiological laboratories the following kinds of literature:

a. Reports of research printed and distributed by the laboratories themselves.
b. Back files and current issues of the more important journals so that field stations can be provided with low cost libraries which occupy only the space of a card file; and
c. Current issues of important foreign journals not found widely available in most smaller libraries.

5. AIBS should extend invitations to membership or affiliation to appropriate societies in Latin America which have biological interests, and to individual biologists especially in those countries where no societies exist. Coinciding with this recommendation, the suggestions in the next recommendation should be noted.

6. The *AIBS Bulletin* should be extended to Western Hemispheric coverage by:

a. Seeking news sources in the Caribbean area, and in Central and South America within organized societies so that a news section for these areas can be established;
b. publishing feature articles on hydrobiology as well as on other biological activities in these areas from time to time;
c. using the AIBS Placement Service to bring about the interchange of teaching and research personnel between the Latin American countries and North America;
d. calling attention to the fact that no requests for biologists have been advertised in the Fulbright Award announcements for Latin America, and that graduate students from Latin America are eligible to apply for Fulbright travel grants to the United States providing they have financial support while in the United States.

7. AIBS should recommend to appropriate governmental agencies that cooperative research programs, including the loan of special equipment, with Latin American agencies and research institutions be facilitated whenever possible, and that the Federal programs aimed at foreign assistance, e.g., Atoms for Peace, be advised specifically of this recommendation.

8. AIBS should send an official expression of approval and gratitude to UNESCO regarding their current undertaking in preparing a trilingual dictionary in the marine sciences, stressing the great utility of such a dictionary and offering the assistance of AIBS within its capabilities.

9. ONR should make official interagency contacts with such programs as ICA, IEES, and the USIS suggesting that attention be directed to assisting the development of other countries in the fields of oceanography, marine biology and fisheries biology."

• **The AIBS Advisory Committee on Biochemistry to the Office of Naval Research** met April 12, 1957 in Miami, Florida to evaluate the scientific merit of research proposals. Chairman of this committee is Severo Ochoa.

• **The AIBS Advisory Committee on Physiology,** under the chairmanship of Gordon Moe, met in Chicago, Ill. on April 14, to evaluate research proposals submitted to ONR.

• **The Office of Naval Research Advisory Committee on Bacteriology** met April 26-27, 1957 in Detroit, Mich. The Committee, under the chairmanship of Roger Porter, voted to place the committee and its administration under the auspices of AIBS after July 1, 1957.

• **The AIBS Advisory Committee on Environmental Biology to the National Science Foundation** met in Boulder, Colo. on June 7-9, 1957 to evaluate research proposals submitted to NSF and to visit the research facilities of the University of Colorado.

• **The second AIBS Symposium, "Molecular Structure and Biological Specificity",** edited by L. Pauling and H. Itano, will not appear until July 1957. Previous announcements stated that the publication date would be March but technical difficulties have delayed the printing. Orders for this Symposium and the first, "Molecular Structure and Functional Activity of Nerve Cells", are being received in the AIBS office. Elsewhere in this issue (page 23) are details of a third Symposium, "Ultrasound in Biology and Medicine", edited by E. Fry, and due to appear by early fall.

• **The AIBS Advisory Committee on Biology to the Office of Naval Research** will meet June 21-22, 1957 at the Marine Biological Laboratory, Woods Hole, Mass. to evaluate the scientific merits of 25 research proposals submitted for consideration.

• **The AIBS Advisory Committee on Systematic Biology** will meet June 28-29, 1957 at the University of Michigan to evaluate the scientific merit of research proposals submitted to the National Science Foundation.

• **An AIBS *ad hoc* Advisory Committee to the National Science Foundation** will meet in late July or early August in St. Louis, Mo. to advise the Foundation with respect to the present status of the Missouri Botanical Garden.

• **AIBS has negotiated a contract, effective May 1, 1957, with the Division of Biology and Medicine, Atomic Energy Commission** for advisory services. Under this contract, AIBS will appoint and administer approximately 10 advisory committees, furnish consultant services and arrange for special conferences and symposia when requested.

• Again this year the **AIBS Placement Service** will be an integral part of the annual meetings. Registration and interview facilities will be provided during the Stanford meetings, August 25-29, with the exact location and hours to be given in the General Program (August). Data on all registrants in the June list will be made available, as well, to prospective employers who visit the Service during the Stanford meeting.

• **The American Society of Human Genetics** voted to raise its membership status in AIBS from that of Affiliate to full Member, effective January 1, 1958. The present membership of the Society is approximately 500.

• **The International Association of Dental Research,** at an Atlantic City meeting in April voted to join the AIBS as an Affiliate Society. This Society has a membership of approximately 2000.

• **The Society of American Bacteriologists,** a charter Member of AIBS that withdrew in June 1951, voted at its recent Detroit annual meeting to apply for Affiliate membership. Membership in S. A. B. is now about 7000.

• **University and college alumni** who wish to hold reunions during the AIBS meetings at Stanford University may make arrangements with the local committee. It is suggested that all such reunions be held Sunday evening, August 25, from 7:00 to 9:00 p.m. Requests for meeting rooms should be sent to Dr. William C. Steere, Dean, Graduate Division, Stanford University, Stanford, California. Special arrangements, such as banquets, teas, etc., cannot be handled by the local committee. A list of organizations and rooms will be posted in prominent places and at the registration desks. If sufficient interest is shown, these reunions can be incorporated as regular features of the annual biology meetings.

• **Information about camping facilities** in California and neighboring states for those attending the Stanford meetings, is as follows:

1. Camping facilities are available within easy driving distance of Stanford, in the beautiful redwood forests of the west slopes of the Coast Range, between Stanford and the Pacific Ocean. Portola Park and San Mateo County Park, about 30 minutes drive from the campus, are part of the San Mateo County Park System. Big Basin, with its magnificent redwoods, is a State Park, with a museum, fine facilities, etc., and is about an hour's drive. It will probably not be possible to reserve camping space in these parks in advance, although such a possibility will be investigated. However, so close to the opening of schools, space should be available.

2. For those who want a list of camping facilities in general, we suggest "Camp Ground Guide," available from Camp Grounds Unlimited, Blue Rapids, Kansas, for $1.00 a copy.

3. For those who want special or general information on the West, the following books, all published by the Lane Publishing Company, Menlo Park, California, are recommended: "Discovery Trips in Arizona," "Discovery Trips in California," "Discovery Trips in Mexico," "Discovery Trips in Oregon," and "Discovery Trips in Washington", at $1.50 each. "Pacific Area Travel Handbook" and Western Campsite Directory" $1.00 each.

• **For those planning to attend the Stanford meetings and wishing motel accommodation rather than dormitory,** the following list of Palo Alto motels is being reprinted: *Bueno Vista Motel and Trailer Park*, 3980 El Camino Real; *Coronet Motel*, 2455 El Camino Real; *Crystalodge*, 3339 El Camino Real; *Currier Motel*, 3200 El Camino Real; *Dinah's New Motor Hotel*, 4269 El Camino Real; *Eldorado Motel*, 3305 El Camino Real; *Flamingo Motor Lodge*, 3398 El Camino Real; *New Cardinal Hotel*, 235 Hamilton Avenue; *Palo Alto Town House*, 4164 El Camino Real; *Palo Alto Travelodge*, 3255 El Camino Real; *Paso Del Norte Motel*, 4238 El Camino Real; *President Hotel*, 488 University Avenue; *Rickey's Studio Inn*, 4129 El Camino Real; *Shangri-La Motel*, 3981 El Camino Real; *Sky Ranch Motel*, 4234 El Camino Real.

• **Additional societies (and their local committee representatives) that have decided since April to meet at Stanford** are: American Chemical Society (California Section), Eric Hutchinson, Chem. Dept., Stanford University; Association of Pacific Coast Geographers, Paul Griffin, Geography Department, Stanford University; Herpetologists' League, George S. Myers, Natural History Museum, Stanford University; Joint Committee on Grassland Farming, W. A. King, Clemson Agricultural College, Clemson, South Carolina; Society of American Bacteriologists (Northern California and Hawaiian Branch), J. L. Stokes, USDA, Regional Lab., Albany, Calif.; Tomato Genetics Cooperative, C. M. Rick, Dept. of Vegetable Crops, University of California, Davis, Calif.; Western Society of Soil Science, C. D. Moodie, Secretary, Department of Agronomy, State College of Washington. Pullman, Washington.

• **The following societies have now named local representatives:** American Society of Human Genetics, C. H. Danforth, Department of Anatomy, Stanford University; Sigma Delta Epsilon, Irene C. Diller, President, Institute for Cancer Research, Fox Chase, Philadelphia, Pa.; Society of General Physiologists, Arthur C. Giese, Department of Biological Sciences, Stanford University.

• **The annual meeting of the Governing Board of the AIBS** will be held at Stanford University, Saturday, August 24th. Details about place and time will appear in the General Program (August).

• **Those biologists who intend to take advantage of United Airlines special tours to Hawaii** before the AIBS meetings open in Stanford, will be interested in seminars and fields trips being planned by the University of Hawaii to coincide with the tours. Calling the program "Practicum in Tropical Biological Sciences", scientists at the University are arranging informal seminars and field trips to acquaint visiting biologists with the tropical crops and the tropical marine work carried on in the Islands. All interested are asked to contact: Dr. Robert W. Hiatt, Dean and Director of Research, University of Hawaii, Honolulu 14, Hawaii, as soon as possible.

• **The Society of Systematic Zoologists** has joined the American Society of Limnologists and Oceanographers and the Ecological Society of America in sponsoring the **field trip, August 29,** to the Hopkins Marine Station and the Hastings Reservation (see April *Bulletin* announcement of California field trips).

## AIBS PLACEMENT SERVICE

Interview services will be available during the Stanford meeting.
AUGUST 25-29, 1957

# Biology Library

*One copy of each publication submitted for listing should be sent to the Editor, AIBS Bulletin, 2000 P Street, N.W., Washington 6, D. C. Only books published within a year of receipt will be reviewed. Books marked with an ★ are those published by Bulletin advertisers.*

## ANIMAL SCIENCES

**The Water Relations of Terrestrial Arthropods.** E. B. EDNEY. 109 pgs., illus. Cambridge University Press, 32 East 57th St., New York 22, N. Y. (1957) $3.00

Terrestrial arthropods, which include insects, spiders, ticks, centipedes, millipedes, woodlice, etc., vary greatly in their adaptation to life on dry land. The various processes of water-uptake, the sources of water-loss, and the means by which a water-balance is achieved are discussed for the group. Recent work on the nature and properties of arthropod cuticles and how water passes through them, has resulted in a reconsideration of many earlier ideas. Recent advances in the physiology of excretion and of osmotic and ionic regulation are summarized. For a small book, on a specialized topic, a considerable amount of material is included. It is number 5 in the series "Cambridge Monographs in Experimental Biology."

**Dahlak.** GIANNI ROGHI and F. BASCHIERI. 280 pgs., illus. Essential Books Inc., 1600 Pollitt Drive, Fair Lawn, N. J. (1957) $6.00

Many physical and biological characteristics sharply distinguish the Red Sea from any other tropical sea. For this reason, and because of its geographical position, it has been the goal of scientific expeditions since the end of the 19th century. In spite of this activity little is known about its biology. Collecting by the conventional methods of net and hook, in a zone rich in coral formation, proved to be extremely difficult. The Italian National Underwater Expedition to the Red Sea and Archipelago of Dahlak obtained specimens by more direct methods. Its members—some sportsmen, some scientists—collected underwater in apnea or with aqualungs. Organisms that were fixed or moved very little were collected by hand; moving animals were caught mostly by underwater gun. The story of the expedition, from December 1952 to June 1953, is told here by two members of the team's scientific group. Gianni Roghi, who held his own camera while he spearfished, wrote a day-by-day account not only of the scientific findings but also of the thoughts and emotions of the underwater explorers. His writing is lively and informative; his photographs are interesting. In a detailed appendix Francesco Baschieri, the expedition's scientific director, furnishes pertinent information on the geology, topography and climate of the region, and a brief natural history of all the organisms encountered. *D. E. Curran.*

**Man as an Animal.** W. C. OSMAN HILL. 176 pgs. Rinehart & Co., 232 Madison Ave., New York 16, N. Y. (1957) $1.50

The fact that man is an animal does not appeal to most persons. Many people pass their entire lives without thinking about it. "Man's attainment in the world of thought, of the arts, sciences, of philosophy, and his inherent religious tendencies, all unite to form the basis of the mental concept that man is a being unto himself—raised ineffably above the realm of ordinary organic beings" writes the author. In this small book, Dr. Hill elaborates upon the "basic determinants that link mankind with the rest of the animal world". Chapter titles indicate the approaches taken: Anatomical arguments, Man and woman, Embryological evidence, Physiological phenomena, Enlightenment from endocrinology, Pointers from pathology and parasitology, Criteria of comparative psychology, Justification from genetics, Fossil forebears; and Ethnic emergence.

**★Boy's Book of Frogs, Toads and Salamanders.** PERCY A. MORRIS. 240 pgs., illus. Ronald Press Co., 15 East 26th St., New York 10, N. Y. (1957) $4.00

This attractive volume may be called a "Boy's Book" but it should appeal to many an older, non-herpetologist "boy". It is ideal for anyone wishing or needing to identify or learn the natural history of frogs, toads and salamanders. The reader is told where to look for the various amphibians and then how to capture them. Their care in captivity and their preservation as permanent study specimens are fully explained. Numerous photographs assist with the identification of particular species. Mr. Morris, also author of *Boy's Book of Snakes*, is chief preparator of the Peabody Museum in New Haven.

## PLANT SCIENCES

**Edward Palmer, Plant Explorer of the American West.** ROGERS MCVAUGH. 430 pgs. University of Oklahoma Press, Norman, Oklahoma. (1956) $6.00

Congratulations to the University of Oklahoma Press for undertaking the publication of this type of book and to the author for the skill and interest with which he prepared this memorial work to an indefatigable scientific explorer. Edward Palmer (1831-1911) was one of the great botanical collectors of his time. Dispite frail health, he faced the hazards of the Western frontier and the northern regions of Mexico to collect, finally, more than 100,000 plant specimens as well as uncounted thousands of archaeological, ethnological, and zoological items. A summary of the known facts about Palmer's collections and his travels has long been needed. The author supplies, for the first time, a detailed index of Palmer's travels, a guide to the location of Palmer's field notes, a list of the herbaria which hold specimens collected by Palmer, and the publication of Palmer's Colorado and Indian Territory notes exactly as he took them. Dr. McVaugh, a fine scientific historian, is Curator of Phanerograms at the University of Michigan Herbarium and Professor of Botany.

**★Vegetable Crops.** HOMER C. THOMPSON and WILLIAM C. KELLY. 611 pgs., illus. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. (5th edition, 1957) $8.50

As in so many other fields of science, recent research advances have made the revision of texts on vegetable crops a necessary task for authors. The fourth edition of this book appeared in 1949; new knowledge since then necessitated essentially a complete revision. Some of the reasons for revision are given as: "Improvements in machinery and equipment allowing increased mechanization in all phases of growing and handling; new and improved insecticides, fungicides, and herbicides; the use of growth regulation compounds other than herbicides; consumer packaging; improved handling of vegetables after harvest, such as vacuum cooling and hydrocooling; and the development and use of new containers for marketing vegetables." *Vegetable Crops* continues to serve equally well as a college textbook or as a reference book for country agricultural agents, extension specialists, teachers of vocational agriculture, seedsmen and other commercial vegetable concerns. The authors are both on the faculty of Cornell University.

**Plant Virus Serology.** R. E. F. MATHEWS. 128 pgs., illus. Cambridge University Press, 32 East 57th St., New York 22, N. Y. (1957) $5.00

About twenty-five years ago serological techniques were first applied for the detection of plant viruses. These methods have since proven extremely useful for virus identification, the routine testing of plants on a commercial scale for freedom from virus infection, and as quantitative methods for assaying viruses. Detailed practical instructions for carrying out tests with plant material are given in this small volume. Although most space is devoted to the precipitation reaction, the use of various other methods is critically discussed and suggestions made for extending their applicability. Immunologists generally will be interested in the section that discusses the high homogeneity of plant virus nucleoproteins and the suitability of these substances for "model" experiments.

**Investigation of Virus Diseases of Brassica Crops.** L. BROADBENT. 94 pgs., illus. Cambridge Univeristy Press, 32 East 57th St., New York 22, N. Y. (1957) $3.00

Serious commercial losses in brassica crops in England from 1948-50 led to a concerted research effort, by the Agricultural Research Council, on practical methods whereby virus diseases could be controlled. Work on the two main viruses concerned were already in progress at the Rothamsted Experimental Station. This work was stepped up. A comprehensive study of the conditions leading to serious outbreaks in field crops soon involved commercial growers as well as scientists. The results of this collaboration are now presented in a rather complete account of the many factors affecting the incidence of brassica virus diseases in Britain.

**★Botany for Gardeners.** HAROLD W. RICKETT. 236 pgs., illus. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. (1957) $4.50

How to grow plants is not the subject of this book. But how plants grow is. What makes a seed sprout, a tree trunk expand, a flower open and why plants need sunlight, air and water are lucidly explained. The natural habits of plants that affect the grower's handling of them and conversely, the gardener's practices, both good and bad, that affect his plants and flowers are discussed in layman's vernacular. The author is staff bibliographer and editor at the New York Botanical Garden and the author of several previous books of general interest, *The Green Earth, An Invitation to Botany,* and *Diseases and Pests of Ornamental Plant.*

**Plant Ecology.** WILLIAM LEACH. 106 pgs. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. (4th edition, 1956) $2.00

This pocket-size volume outlines the essential principles and practices of plant ecology in a brief but quite adequate fashion. The book is obviously not meant for advanced students of ecology, but should make fine introductory or supplementary reading. The fourth edition has been completely revised and largely rewritten, although the examples of plant community flora remain British.

**★Fundamentals of Horticulture.** J. B. EDMOND, A. M. MUSSER, and F. S. ANDREWS. 456 pgs., illus. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. (2nd edition, 1957) $6.75

The stated purpose of this book is to "provide an opportunity for the student (1) to acquire a working knowledge of the fundamentals of plant growth, (2) to develop the ability to apply the fundamentals to the solution of practical problems, and (3) to obtain an appreciation of the significance of horticulture in human affairs". The text is accordingly divided into three parts along these lines. Yet in so doing "plant growth and development" must be compressed into 120 moderate sized pages, "principal horticultural practices" into 160-odd, and "principal horticultural crops" into less than 200. These are not fairly regarded as specific faults of the text under review. For so long as each of the numerous plant science specialties, particularly in the agricultural field, maintains its individual beginning course, we will need texts which presuppose no knowledge of botany. And *Fundamentals of Horticulture* seems to fill this need adequately. It is logically arranged, well illustrated, and as complete as can be expected. Supplemented by the instructor, and perhaps particularly by some of the excellent state and Federal bulletins and pamphlets currently available, it should prove an eminently satisfactory text. *Russell Stevens*

**Botany: an Introduction to Plant Science.** W. W. ROBBINS, T. E. WEIER and C. R. STOCKING. 578 pgs., illus. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. (2nd Edition, 1957) $6.95

This book, if we may accept the authors' (Weier and Stocking) preface, is designed to serve both the science major and a terminal course for the nonscience student. Certainly it will become a respected member of that growing family of "modernized" introductory botany texts aiming, through profuse illustration, varied type face, and attractive format, to catch the eye and stir the interest of the beginning student. With the exception of the color plates, in which this reviewer sees neither quality, significance, nor appeal, the book is superbly illustrated with half-tone photographs, well supported by line drawings.

Two major changes from the first edition are indicated by the authors: (1) transfer of physiology from chapters on root, stem, and leaf into new chapters dealing almost exclusively with physiology; and (2) major revision of the material on angiosperms, designed to bring out comparisons with lower forms. The text, like any, reflects the particular teaching techniques of the authors. They adopt, for example, the device of boldface type for each new term at its first appearance, and of "numerous strategically placed summaries"—the latter often as a numbered series of statements. Whether these features will appeal to the prospective user is debatable, and in any event is a matter for individual decision. *Russell Stevens.*

**Bibliography of Forest Disease Research in the Department of Agriculture.** Edited by AGNES E. MOORE. 186 pgs. Miscellaneous Publication No. 725, U. S. Department of Agriculture. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. (1957) $.55

## MISCELLANEOUS

**Vapour Phase Chromatography.** Edited by D. H. DESTY. 436 pgs., illus. Academic Press Inc., 111 Fifth Ave., New York 3, N. Y. (1957) $12.00

In the summer of 1955 the Hydrocarbon Research Group of the Institute of Petroleum (England) decided, in view of the rapidly increasing interest in gas chromatrography, to hold a symposium. In May of 1956 the Symposium was held, attended by nearly four hundred persons from thirteen different countries. Thirty-four papers were presented and they now appear in this volume, with discussions and nomenclature recommendations. For all scientists working in the field of chromatography, paper, liquid or gas, this book contains much of interest and is a most complete summary of knowledge in the particular field of gas analysis.

**Tranquilizing Drugs.** Edited by HAROLD E. HIMWICH. 205 pgs., 32 illus. American Association for the Advancement of Science, 1515 Masschusetts Ave., Washington 5, D. C. (1957) $5.00 ($4.50 to AAAS members)

Scientists and laymen alike who have indulged in extensive conversation and expressed controversial viewpoints about the new tranquilizing drugs will welcome this volume. The papers it contains were presented during a symposium (AAAS Atlanta meeting) co-sponsored by the American Psychiatric Association and the American Physiological Society. Scientists of many different disciplines participated. The first section contains papers on "Electrophysiological Analysis of Tranquilizing Drug Action"; the second on "Metabolic Analysis of Drug Action" and a final section on "Therapeutic Considerations Regarding Tranquilizing Drugs". The papers reflect the nation-wide concern over the possibilities of improving psychiatric treatment by means of the new chemicals.

**★Dairy Microbiology.** E. D. M. FOSTER, F. E. NELSON, M. L. SPECK, R. N. DOETSCH, and J. C. OLSON, JR. 492 pgs., illus. Prentice-Hall, Englewood Cliffs, N. J. (1957) $4.25

*Dairy Microbiology* is so designed that all dairy plant operators, fieldmen, laboratory personnel, sanitarians and bacteriology students who intend to specialize in this field will find it an excellent working reference. Important characteristics of organisms found in dairy products are catalogued, and their pertinence to dairy processing presented. Factors influencing growth and death of microorganisms, sources of contamination, use of beneficial dairy organisms, and physical and chemical methods of killing microorganisms are discussed in detail. Seven chapters are devoted to the microbiology of specific dairy products-market milk, fermented milks, cheese, butter, and evaporated, condensed, dried or

frozen products. The book is the result of the concerted efforts of five authors, all experts in different fields and associated with different universities.

**A Guide to Qualitative Organic Chemical Analysis.** R. P. LINSTEAD and B. C. L. WEEDON. 169 pgs., illus. Academic Press Inc., 111 Fifth Ave., New York 3, N. Y. (1957) $4.50

This small textbook is based on the teaching method established by the authors at the Imperial College of Science and Technology, London. The treatment is elementary, primarily intended for first and second year chemistry students. However, many postgraduate students have a continuing need for reliable methods and biologists and biochemists find the detection and characterization of organic compounds necessary to their work. Apart from this useful, technical aspect of the subject, the authors "regard qualitative organic analysis . . . of very great educational value. It affords valuable training in deductive reasoning, practice in close observation and good experience of small-scale experimental work".

**Venoms.** Edited by ELEANOR E. BUCKLEY and NANDOR PORGES. 480 pgs., 113 illus. American Association for the Advancement of Science, 1515 Massachusetts Ave., Washington 5, D. C. (1956) $9.50 ($8.25 to AAAS members)

It is difficult to imagine a more comprehensive treatment of the subject of animal venoms. Just as the lower animals which possess mechanisms for secretion and ejection of toxic substances are worldwide in distribution, the contributors to this symposium were international. Since numerous scientific disciplines are involved in solving the problems of the fields, the contributors are drawn from many areas of science. Sixty-one individual papers are included. Particular poisonous culprits discussed are: poisonous fishes, stingrays, gila monsters, toads, spiders including the Black Widow, caterpillars, insects, scorpions, and snakes, including cobras, rattlesnakes, and vipers. Subjects range from "Cardiovascular Effects of the Venom of the Round Stingray *Urobatis halleri*", through "Anticoagulating Action of Cobra Venom" and "The Hyaluronidase Content of Animal Venoms" to "Snakebite in India". An interesting historical chapter, "Development of Knowledge about Venoms" by Chauncey Leake introduces the volume.

**The Adrenal Cortex.** I. CHESTER JONES. 316 pgs., illus. Cambridge University Press, 32 East 57th St., New York 22, N. Y. (1957) $7.00

This monograph offers a comprehensive account of the anatomy and function of the adrenal cortex in vertebrates. The first chapter, on mammals including man, is the longest since research with mammalian subjects is the most intensive and is increasing constantly. Every aspect is treated; structure, relationship to other parts of the body, nature and formation of its products, control of secretion, and effects of abnormalities. Remaining chapters deal with the adrenal cortex in fish, amphibians, reptiles, birds and monotremes and marsupials. The material on the lower vertebrates should prove stimulating to zoologists, since much less is known about these groups and much remains to be discovered. The bibliography contains over 1200 references, leading to all of the major contributions in the field. The author is lecturer in the Department of Zoology at the University of Liverpool.

**The Neurohypophysis.** Edited by H. HELLER. 275 pgs., illus. Academic Press Inc., 111 Fifth Ave., New York 3, N. Y. (1957) $9.50

The 8th Symposium of the Colston Research Society held at the University of Bristol, England, April 1956, was the first international meeting devoted entirely to the subject of the neurohypophysis. The proceedings of the Symposium, published in this volume, attest to the diverse aspects of the problem discussed and clearly illustrate the rapid progress that has been made in the field in recent years. The Editor writes in the preface, "This progress has been essentially twofold. Firstly, there is now strong suggestive evidence that the neurohypophysial hormones are elaborated not in the posterior pituitary lobe but in the hypothalamus and several of the papers read were concerned with the implications of this concept. Secondly, the chemical nature of the active principles—in some mammalian species at least—has been established." Eighteen papers are included, the extensive discussions following each are reported and bibliographies usually appended.

**Gestation.** Edited by CLAUDE A. VILLEE. 253 pgs., illus. Josiah Macy Jr. Foundation, 16 West 46th St., New York 36, N. Y. (1957) $4.75

This, the proceedings of the 3rd Macy Conference on Gestation, contains the following papers and authors: Maternal Endocrine Secretions, Gregory Pincus; Maternal Hormones in Pregnancy, M. X. Zarrow; Ovulation Cycles and Stress, Curt P. Richter; The Secretions of Various Hormones and the Activity of the Adrenal Cortex in Pregnancy, E. G. Venning; Steroidogenesis in Perfused Human Placentas, Gregory Pincus; Effect of Hormones on Cellular Metabolism, C. A. Villee; Etiology of Gonadal Agenesis and Sex Reversal, Emil Witschi; The Secretory Activities of Fetal Endocrine Glands and Their Effect Upon Target Organs, Alfred Jost; Influence of Hormones on Sex Differentiation in Explanted Fetal Reproductive Tracts, Dorothy Price; Effect of Fetal Endocrines on Fetal Growth, Lemen J. Wells; and Interrelations of Pituitary Functions and Pregnancy, Roy O. Greep. The usual high caliber of subject and participant is maintained.

**Cold Injury.** Edited by M. IRENE FERRER. 371 pgs., illus. Josiah Macy Jr. Foundation, 16 West 46th St., New York 36, N. Y. (1956) $5.95

With the current research upswing in Arctic and Antarctic regions of the world, encouraged particularly by the International Geophysical Year, interest in and concern about cold injury has likewise increased. This is the 4th Macy Foundation Conference on the subject. A considerable amount of very valuable information has been collected in the proceedings of these Conferences. The present edition contains the following papers: Follow-up Study of Cold Injury Cases from the Korean War; Roentgenologic Changes in Bones Following Cold Injury in Man; Experimental Cold Injury in the Rabbit; Roentgenologic Changes in Frostbitten Rabbits; Histopathologic Studies in Frostbitten Rabbits; Changes in Cellular Metabolism Following Experimental Cold Injury; Experimental Immersion Foot in the Rabbit; A Preliminary Follow-up Report on Cases of Cold Injury from World War II; Resuscitation of Hypothermic, Supercooled, and Frozen Mammals; Blockade Techniques as Protective Measures Against Ventricular Fibrillation during Hypothermia; Clinical Application of Hypothermia During Open Heart Surgery; and Cerebral Studies During Local and General Hypothermia.

**The Structure of Nucleic Acids and Their Role in Protein Synthesis.** Edited by E. M. CROOK. 74 pgs., illus. Cambridge University Press, 32 East 57th St., New York 22, N. Y. (1957) $3.75

The Biochemical Society Symposium No. 14, held at the London School of Hygiene and Tropical Medicine, February 1956 forms the basis of this book. Subjects and authors include: Recent Views on the Chemical Structure of the Polynucleotides, R. Markham; Molecular Structure of Deoxyribose Nucleic Acid and Nucleoprotein and Possible Implications in Protein Synthesis, M. H. F. Wilkins; Nucleic Acids and Protein Synthesis in Animal Tissues, B. A. Askonas, J. R. L. Simkin and T. S. Work; Nucleic Acids and the Incorporation of Amino Acids, E. F. Gale; Interrelationships of Nucleic Acids and Protein in the Multiplication of Bacteriophage, K. Burton.

**Alcoholism, Basic Aspects and Treatment.** Edited by HAROLD E. HIMWICH. 220 pgs., 33 illus. American Association for Advancement of Science, 1515 Massachusetts Ave., Washington 5, D. C. (1957) $5.75 ($5.00 to AAAS members)

In his preface, the editor writes, "Like many other important issues the use of alcohol is controversial, but such a divided attitude does not apply to alcoholism, which is a disease and requires treatment. An aid in understanding disease is the acquisition of information." The Symposium (Atlanta AAAS meeting) upon

which this book is based, was essentially information-gathering. New data on the fundamental aspects of this problem are supplied in the first section. Such studies are necessary not only for their theoretical scientific value but also for their practical contributions to the treatment of alcoholism. Two aspects of treatment, pharmacological and psychological, are applied in varying degrees by the contributors to the second portion of the book. An historical introduction by Chauncey D. Leake greatly improves the appreciation of succeeding papers.

**The Physiology of Nerve Cells.** J. C. ECCLES. 270 pgs. Johns Hopkins University Press, Baltimore, Maryland. (1957)

This book represents an expansion of the author's Herter Lectures given at the Johns Hopkins University in 1955. Derived mainly from studies with the microelectrode, the discussion considers the neuron and its excitatory and inhibitory reactions, interaction of excitatory and inhibitory processes, and neural pathways and synaptic transmitter substances in the central nervous system. There is in conclusion a speculative consideration of the functional architecture of the central nervous system. Those who read this book will undoubtedly agree with its author that "It is not unreasonable to maintain that nerve cells are more interesting and important than any other cells, being, as they are, the unitary constituents of the nervous system and the functional units responsible for all its multifarious activities, including the amazing performance of the human brain . . .". *J. F. Case*

**★Introduction to Bacterial Physiology.** C. E. CLIFTON. 414 pgs., illus. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. (1957) $8.50

As the behavior of bacteria is studied and explained in terms of chemistry and physics the science of bacteriology approaches a maturity not otherwise possible. The author of this book properly assumes a background in chemistry and basic bacteriology, and approaches the subject from both biological and chemical viewpoints. The book begins with a basic review of physical and colloidal chemistry, and bacterial cytology on which to build a sound understanding of the physiological processes occurring in bacteria. While principles are emphasized, detail is given where it is needed or useful to the students' understanding of fundamentals.

Dogmatic treatment of controversial subjects is avoided. Fair and reasonable interpretations are presented on the basis of the best available information. That such interpretations may need modification or change in the light of data to be obtained in the future is made clear. Reference lists at the ends of chapters are not extensive but have been carefully selected to provide adequate sources for additional study. The book is well written and organized. It should be very useful as a textbook for students of Bacterial Physiology or as supplemental reading for those in the elementary courses. *Roger D. Reid*

**The Life and Death of Cells.** JOSEPH G. HOFFMAN. 301 pgs. Doubleday & Co., 575 Madison Ave., New York 22, N. Y. (1957) $4.50

This is a fascinating book! It describes and analyses the living process as observed in the simplest unit of life, the cell. The author, a professor of biophysics at the University of Buffalo School of Medicine, approaches his subject with the intention of stating the "salient features of life . . . in mechanistic terms". He has succeeded in translating a wealth of technical data into material that can be easily read and assimilated by the non-specialist. The biology of cancer is discussed as an example of the fundamental processes of life gone wild. Descriptions of known biological phenomena lead to molecular phenomena, for the author feels that the "behavior of living matter depends on the reactions of special molecules made within the living cells". But, he concludes, "the blueprint by which the many different molecules are constructed has yet to be found." *D. E. Curran*

**Laboratory Glass-Working for Scientists.** A. J. B. ROBERTSON, D. J. FABIAN, A. J. CROCKER and J. DEWING. Academic Press Inc., 111 Fifth Ave., New York 3, N. Y. (1957) $4.00

Here in the United States, where team and project research is yearly assuming greater importance, the day of the individualist seems on the wane. This book is definitely for the individualist. Standard investigations usually require standard apparatus—easily purchased—but the diversity and complexity of many present-day experiments demand custom-made apparatus. Most chemists, physicists, and biologists have attempted laboratory glass blowing at some point in their careers, only to discover the considerable skill it takes. Glass working is an art and a very challenging one. This book is heartily recommended to all who have been or expect to be confronted with the necessity of creating a special piece of glass laboratory equipment.

**The Darwin Reader.** Edited by MARSTON BATES and PHILIP S. HUMPHREY. 470 pgs., illus. Charles Scribner's Sons, 597 Fifth Ave., New York 17, N. Y. (1956) $6.75

A very worthwhile task has been performed by the two editors of this book. For the first time, the "meat" of Darwin's five books has been selected and edited into one eminently readable volume. From *The Autobiography, The Voyage of the Beagle, The Origin of the Species, The Descent of Man, The Expression of the Emotions* and some less-well known works, the editors have selected the material that is most illustrative of Darwin's important and interesting ideas. The selections have not been rewritten—they are pure Darwin. The very readable prose paints a picture of an immensely curious and indefatigable mind. For those interested in further reading, the editor's have appended a critical bibliography.

**★The Galathea Deep Sea Expedition.** Edited by A. F. BRUUN, S. GREVE, H. MIELCHE, and R. SPÄRCK. 296 pgs., illus. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. (1956) $8.00

Translated from the Danish by Reginald Spink, this absorbing story is the record of the fourth marine-biological world expedition ever to be made. The Danish ship *Galathea* made the trip during 1950-52 and the scientists aboard the vessel describe not only the animal life found in all of the Seven Seas but the techniques of modern trawling, echo-sounding, and measuring the productivity of the sea and animal density. Included as well are descriptions of some of the places visited — the Seychelles, islands of the giant palms; the Nicobars; Rennell, an out of the way coral island; and Campbell Island, home of elephant seals and albatrosses. Innumerable photographs and halftone illustrations add interest and value to the excellent account. The *Galathea* should find its way to every biologists' library shelf.

**Questions and Problems in Science.** Test Item Folio No. 1. PAUL L. DRESSEL and CLARENCE H. NELSON. 805 pgs. Cooperative Test Division, Educational Testing Service, 20 Nassau St., Princeton, N. J. (1956)

For those universities and colleges that have decided to, or found it necessary to, give objective examinations (often machine marked) to undergraduate classes, this publication will be worth investigating. Believing that many instructors find the preparation of really good examinations difficult, the Educational Testing Service, with the assistance of several institutions, prepared this folio. A hard cover, loose-leaf creation, half of it is devoted to 31 categories of questions in the biological sciences, and the remaining half to 29 categories in the physical sciences. The Service believes that by making available a large pool of quality items, from among which the instructor can select any combination he desires, the advantages inherent in the use of well constructed standardized tests remain but the instructor is freed for teaching or research.

**Biographical Memoirs. National Academy of Sciences. Vol. XXX.** 409 pgs. Columbia University Press, 2960 Broadway, New York 27, N. Y. (1957) $5.00

The thirtieth edition of the National Academy of Science's *Biographical Memoirs* contains tributes to the following men: Warder Claude Allee, Charles P. Berkey, George K. Burgess, Charles Manning Child, John Dewey, Enrico Fermi, Bancroft Gherardi, Frank R. Lillie, Theodore Lyman, George A. Miller, Charles Palache, Lewis J. Stadler, Louis L. Thurstone, Alfred M. Tozzer, and Edward B. Van Vleck.

**★Guide to Medical Writing.** HENRY A. DAVIDSON. 338 pgs. Ronald Press Co., 15 East 26th St., New York 10, N. Y. (1957) $5.00

The material in this book, although directed to a medical audience can be equally well used by scientists generally. The prospective author has shown how to pin down ideas, how to organize subjectmatter, how to put it in readable form, and how to master the mechanics of presentation. The author has concentrated on practical points—research methods, outlining, revision, summaries, the choice of vigorous words, and the arrangement of pictures and charts. Chapters are devoted to the intricacies of punctuation, spelling, grammar, footnotes and bibliography. Physicians, dentists, nurses, pharmacists, clinical psychologists, social workers and veterinarians—all in the health field—will find the book particularly useful. But anyone about to write an article, abstract, book review, editorial or book will benefit from a perusal of the contents.

**When Doctors Meet Reporters.** HILLIER KREIGHBAUM. 119 pgs. New York University Press, Washington Square, New York 3, N. Y. (1957) $2.50

Under the auspices of the Josiah Macy Jr. Foundation, a group of physicians and science writers first met in June 1953 to explore possible ways of improving the press reporting of medical news. During the next three years additional meetings were held. This small paperbound book contains the highlights of these informal discussions. The differences in outlook and attitude on both sides are aired, the points of agreement and misunderstanding discussed and better methods of cooperation for the future outlined. The problems involved in medical writing apply to science writing and reporting generally—therefore biologists will also find much of interest in these sessions.

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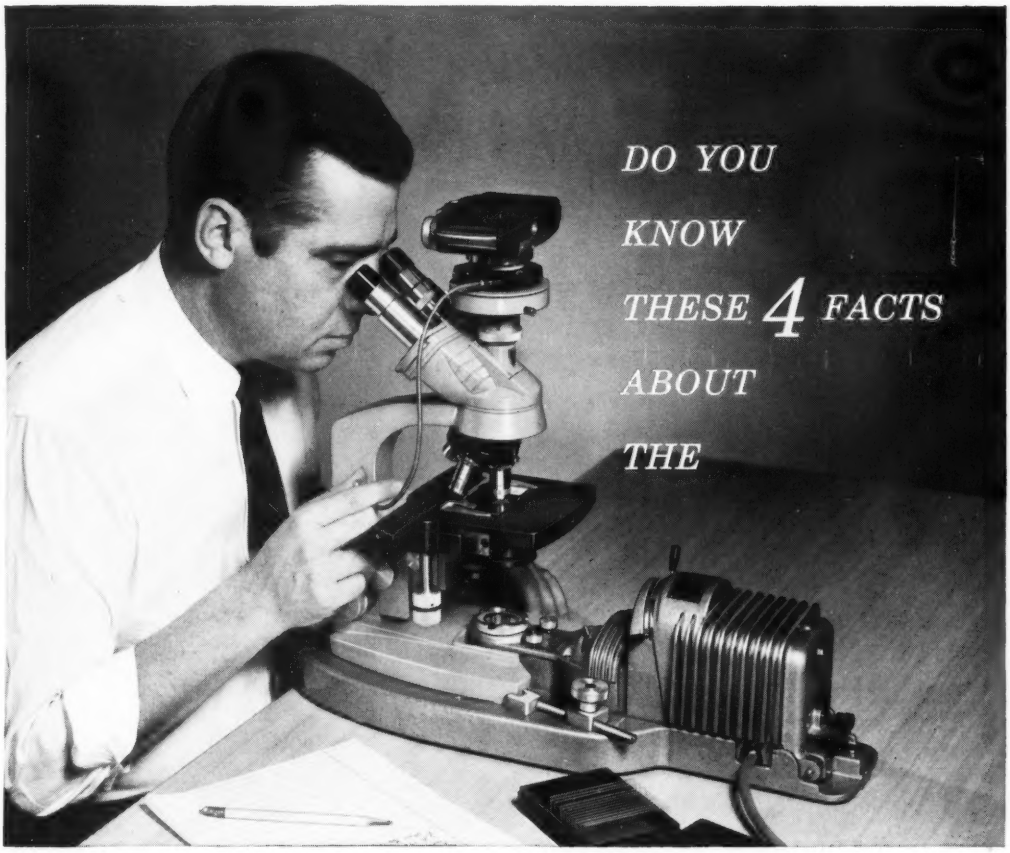


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